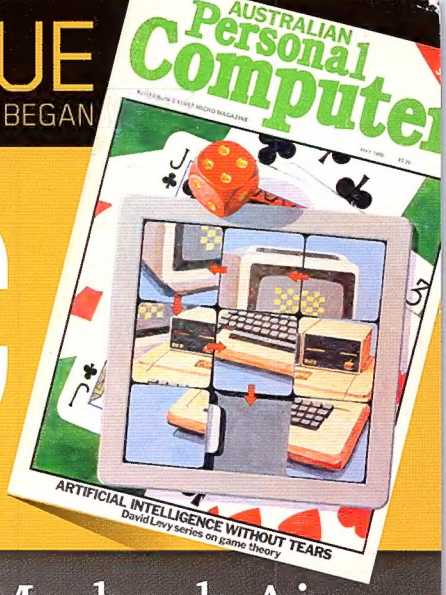
EW
OOK
PC

40th ANNIVERSARY ISSUE

SPECIAL COLLECTOR'S EDITION

1980, WHEN IT ALL BEGAN



apc

SINCE 1980

YOUR EXPERT GUIDE TO TODAY'S TECH

JUNE 2020 #481

The Compucolor II

APC'S FIRST REVIEW

Apple Macbook Air

SLEEK AND POWERFUL

Get set up with a new PC

The critical first 30 minutes

IOW FAR WE'VE COME

THEN & NOW

APC CELEBRATES 40 YEARS OF TECH & INNOVATION

LOOKING BACK SPECIAL FEATURE

Inside issue 1

- FORMER STAFF DISCUSS THE EARLY DAYS
- PC HITS AND MISSES OVER THE YEARS

IDIA DLSS
w machine
rning is
nging gaming

YBOARD
PES COMPARED
mbrane vs.
chanical vs. optical

Asus ROG Zephyrus G14

Leading AMD's mobile revival

FUTURE

AUS$9.95 INC GST NZ$10.90 INC GST
PRINT POST APPROVED 100000179
ISSN 0725-4415

9 313006 001362 06

4G LTE
NBN-Ready Routers

Mobile Internet Solution for Small-to-Medium Businesses

DrayTek Aust & NZ
www.draytek.com.au

Supports 4G LTE bands: B1/B3/B5/B7/B8/B28/B40 (Bands vary pending models)
Great coverage in Australia and New Zealand

- Provision of Internet access on public transport such as coaches, buses, trains, freighters, etc.
- Temporary installations such as disaster recovery and emergency situations, exhibitions, sporting events, etc where Internet access is required for a short period.
- Quick setup for remote location or new branches waiting for xDSL/Ethernet WAN (e.g. NBN).
- Multi-WAN series LTE routers (i.e. Vigor2862L, Vigor2926L) support Load Balancing and Failover functions.
- Single WAN series LTE routers support failover functions between xDSL/Ethernet/LTE connections for Vigor2620L, or between Ethernet/LTE connections for VigorLTE 200n.

Vigor2862 LTE Series

Aust/NZ VDSL NBN Ready | Ethernet WAN NBN Ready | Ethernet WAN UFB Ready | SIM Card | 32x VPN

- 4G LTE Multi-WAN router with SIM card slot
- VDSL2/ADSL2+, 1 x configurable GbE WAN/LAN port, 1 x USB port for 3G/4G LTE Modem
- SPI Firewall, 802.11ac Wave 2 Wi-Fi
- 16 x VLANs, 32 x VPN tunnels (including 16 x SSL-VPN tunnels)
- Central VPN Management
- Central AP Management
- Support VigorACS 2 (Central Management System) for remote management

Vigor2926 LTE Series

Ethernet WAN NBN Ready | Ethernet WAN UFB Ready | SIM Card | 50x VPN

- 4G LTE Multi-WAN router with SIM card slot
- 1 x GbE WAN ports, 1 x configurable GbE WAN/LAN port, 1 x USB port for 3G/4G LTE Modem
- SPI Firewall, 802.11ac Wave 2 Wi-Fi
- 16 x VLANs, 50 x VPN tunnels (including 16 x SSL-VPN tunnels)
- Central VPN Management
- Central AP Management
- Support VigorACS 2 (Central Management System) for remote management

Vigor2620 LTE Series

Aust/NZ VDSL NBN Ready | Ethernet WAN NBN Ready | Ethernet WAN UFB Ready | DUAL SIM | 2x VPN

- 4G LTE router with dual SIM card slots (SIM slot 2 for failover)
- VDSL2/ADSL2+, 1x configurable GbE WAN/LAN port
- 1 x GbE LAN port
- SPI Firewall
- 802.11n Wi-Fi
- 2 x VPN tunnels including SSL-VPN
- Central AP Management
- Support VigorACS 2 (Central Management System) for remote management

VigorLTE 200n

Ethernet WAN NBN Ready | Ethernet WAN UFB Ready | DUAL SIM | 2x VPN

- 4G LTE router with dual SIM card slots (SIM slot 2 for failover)
- 1x configurable GbE WAN/LAN port
- 1 x GbE LAN port
- SPI Firewall
- 802.11n Wi-Fi
- 2 x VPN tunnels including SSL-VPN
- Central AP Management
- Support VigorACS 2 (Central Management System) for remote management

i-LAN TECHNOLOGY

i-LAN Technology Pty Ltd trading as DrayTek Aust & NZ
www.i-lan.com.au (02) 9838 8899 sales@i-lan.com.au
www.draytek.com.au

© Copyright 2020 i-LAN Technology Pty Ltd. All rights reserved.

EDITORIAL

WELCOME TO A VERY SPECIAL ISSUE OF *APC*

"This issue of APC, our four hundred and eighty first, marks the big four-zero for us. It's a heck of a milestone by any measure. I'm told we're also the longest running PC magazine in the world!"

40th ANNIVERSARY ISSUE
apc
The Compucolor II
Apple Macbook Air
Get set up with a new PC
HOW FAR WE'VE COME
THEN & NOW
APC CELEBRATES 40 YEARS OF TECH & INNOVATION
What we said in issue 1
Asus ROG Zephyrus G14
Leading AMD's mobile revival

EDITORIAL

Time and evolution

Of PCs and a magazine.

A magazine like *APC* marches to the beat of the ever-evolving PC, and the PC never sits still. Every month, for 40 years, we've documented that change and progress, and there's never once been a dull month.

APC magazine exists because the PC is a marvellous, wonderful, world-changing creation – but it *thrives* because it's written and read by people that are truly, madly, deeply in love with it.

This issue of *APC*, our four hundred and eighty first, marks the big four-zero for us. It's a heck of a milestone by any measure. I'm told we're also the longest running PC magazine in the world! If the team that produced issue one, which went onsale back in May 1980, knew their baby would still be going strong so far down the track I wonder what they would say?

Well, let's find out. Starting on page 30 we have a special feature looking back at issue one, with some words from its editor – the first editor of *APC* (or to be correct, *Australian Personal Computer*) – Sean Howard. We've chosen some of our favourite pages to share with you, too, and it's a fascinating insight into the technology of the time.

Other former *APC* editors and journalists over the years have also kindly shared some words about their time on the magazine, and their reminiscing covers a great many years of our history, along with PC tech trends over the years and the gear that surprised us with its success, and disappointed with failure.

We're also celebrating the big birthday with a bit of evolution in *APC* itself. The first thing you'll notice is our fresh new look! It's been a while since *APC* had a redesign and rolling it out for this issue makes it even more special. Our goal was more than just a nicer looking *APC* (nothing wrong with that!), we've also worked on readability and added a writer's photo here and there so you know who we are.

We're also adding two new columnists that are experts in their fields. Joining Shaun, Joel and Chris are Jarred Walton with his Open Source column, while Alex Campbell writes each month on the current state of PC tech. Collectively these talented writers provide invaluable insight and understanding into tech and the way it affects us, and the world.

Plus, because many of us have a deep fondness for old tech, we have our new Machine of the Month feature, looking back at pivotal – or just interesting – computers or devices from the early days. And, because we like to tinker, we'll provide instructions where possible for running emulations or some way to have a play with the old tech. The first featured machine is the well-loved Amiga 500!

APC has changed. We're now read more and more on digital platforms through Google's Play Store and the iOS Newsstand, and in the current pandemic that's an especially great way to get your monthly *APC*, and support us doing what we do.

Whether you are new to this magazine or have been reading *APC* for many, many years, it is you we ultimately thank for making it this far. I hope we can continue to please you for many years to come. On behalf of everyone that's ever worked on *APC* I raise a glass to you, to the magazine, and to the PC we love!

BEN MANSILL

DOWNLOADS

FREE FULL SOFTWARE FOR APC READERS

Exclusive downloads

How to download your free full-version programs.

Please note that these exclusive downloads will only be available for a limited time, from 18/05/2020 to 05/07/2020.

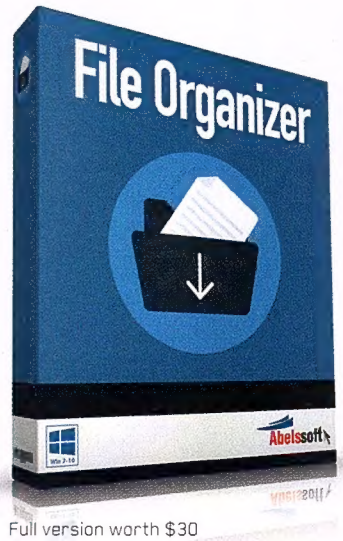
Full version worth $30

Encrypt with ease

Protect sensitive files with Steganos Privacy Suite 20

Download link: tinyurl.com/APC481Steganos

Steganos Privacy Suite 20 combines the award winning Steganos Security software products Steganos Safe and Steganos Password Manager. Users are able to encrypt sensitive data like business reports, TAN lists or holiday photos thanks to a clear and easy menu navigation – on PCs, in networks and in the cloud. Passwords for all online accounts can be created automatically and are easily managed and administrated, regardless of whether it is on a computer, smartphone or tablet.



Full version worth $30

Eliminate clutter and confusion

Be tidy with Abelssoft File Organizer.

Download link: www.apcmag.com/exclusives

Download ZIP password: April20d

Downloads, new photos, current documents: For many users, these files first end up directly on the desktop, and naked chaos soon breaks out. The new Abelssoft File Organizer ensures order – fully automatically. The File Organizer creates its own icon on the desktop. If you drag a file onto this icon, it will be processed automatically according to previously set rules. Depending on the file type or certain letter sequences in the file name, the files can be moved to a certain folder and thus automatically sorted away. Files can also be compressed, copied or deleted automatically. The delete function is worthwhile for downloads that are automatically removed from the computer after a few days if desired, so the download folder always remains empty.

DISCLAIMER Future Publishing is not the licensor of the exclusive software or any documentation included with it. Rather, Future is merely a distributor of the software, and your use of the software is subject to any accompanying third-party licence terms. You must carefully read and comply with any such third-party licence terms, together with all instructions and README files that come with the software. Accordingly, to the maximum extent permitted by law, all software is provided by Future 'as is' and without warranty either express or implied, and Future will not be liable for any damage that you may incur as a result of using any software downloads. You should back up any important system and data files before using any downloaded software. We recommend that you do not use the exclusive software on a production machine. Nothing in this disclaimer excludes any warranty that may be implied by statute, which may include the Trade Practices Act. While we have taken all reasonable steps to check the software downloads for viruses, we cannot guarantee that it is free from viruses or other harmful code and you should check each download using a virus scanner complete with the latest antivirus updates before use.

Subscription enquiries:
(02) 8227 6486, future@crmaus.com.au

Future Publishing Australia
PO Box 1077 Mount Street,
North Sydney, NSW 2059
Tel: (02) 9955 2677 **Fax:** (02) 9955 2688
Email: apcmag@futurenet.com
Web: www.apcmag.com

Editorial
Editor: **Ben Mansill** ben.mansill@futurenet.com
Senior Journalist: **Shaun Prescott**
Journalist: **Joel Burgess**
Journalist: **Harry Domanski**
Journalist: **Stephen Lambrechts**
Journalist: **Sharmishta Sarkar**
Creative Director: **Troy Coleman**
Designer: **Sharnee Swinnerton**

Contributors
Alex Campbell, Hope Corrigan, Sean Endicott, Christian Guyton, Phil Iwaniuk, Hollin Jones, Andy Kelly, Luke Kemp, John Knight, Srivats Lakshman, Gerald Lynch, Steve Lynch, Carrie Marshall, Morgan Park, Nick Peers, Avram Piltch, Les Pounder, Nick Ross, Shashank Sharma, Zak Storey, Tom Sykes, Chris Szewczyk, Jarred Walton, Rachel Watts, Mark Williams, Darren Yates

Photography
All copyrights and trademarks are recognised and respected

Advertising
Group Advertising Manager: **Cameron Ferris**
cameron.ferris@futurenet.com

Management
Managing Director: **Neville Daniels**
Sales Director: **Paul Marttila**

Printed by Blue Star PRINT (NSW)

Distributed in Australia and NZ by Ovato
ovato.com.au

ISSN 0725-4415

We are committed to only using magazine paper which is derived from responsibly managed, certified forestry and chlorine-free manufacture. The paper in this magazine was sourced and produced from sustainable managed forests, conforming to strict environmental and socioeconomic standards. The manufacturing paper mill holds full FSC (Forest Stewardship Council) or PEFC certification and accreditation

All contents © 2018 Future Publishing Australia or published under licence. All rights reserved. No part of this magazine may be used, stored, transmitted or reproduced in any way without the prior written permission of the publisher. Future Publishing Limited (company number 2008885) is registered in England and Wales. Registered office: Quay House, The Ambury, Bath BA1 1UA. All information contained in this publication is for information only and is, as far as we are aware, correct at the time of going to press. Future cannot accept any responsibility for errors or inaccuracies in such information. You are advised to contact manufacturers and retailers directly with regard to the price of products/services referred to in this publication. Apps and websites mentioned in this publication are not under our control. We are not responsible for their contents or any other changes or updates to them. This magazine is fully independent and not affiliated in any way with the companies mentioned herein.

If you submit material to us, you warrant that you own the material and/or have the necessary rights/permissions to supply the material and you automatically grant Future and its licensees a licence to publish your submission in whole or in part in any/all issues and/or editions of publications, in any format published worldwide and on associated websites, social media channels and associated products. Any material you submit is sent at your own risk and, although every care is taken, neither Future nor its employees, agents, subcontractors or licensees shall be liable for loss or damage. We assume all unsolicited material is for publication unless otherwise stated, and reserve the right to edit, amend, adapt all submissions.

Privacy statement
If you provide information about yourself this will be used to provide you with products or services you have requested. We may supply your information to contractors to enable us to do this. Future Publishing Australia will also use your information to inform you of other publications, products, services and events. Future Publishing Australia may also give your information to organisations that are providing special prizes or offers and are clearly associated with the Reader Offer. Unless you tell us not to, Future Publishing Australia may give your information to other organisations that may use it to inform you of other products, services or events. If you would like to gain access to the information Future Publishing Australia holds about you, please contact us.

FUTURE
Connectors. Creators. Experience Makers.

Future plc is a public company quoted on the London Stock Exchange (symbol: FUTR)
www.futureplc.com

Chief executive **Zillah Byng-Thorne**
Non-executive chairman **Richard Huntingford**
Chief financial officer **Penny Ladkin-Brand**

Tel +44 (0)1225 442 244

ASUS®
IN SEARCH OF INCREDIBLE

ASUS ZenWiFi Mesh WiFi System

WiFi Coverage Everywhere. Always Secure.

2 Pack

www.asus.com/au/Networking/ZenWiFi-AX-XT8/

Unique antenna design for multi-floor signal

Life-time free network security

Tri-band design for non-compromised speed

ZenWiFi AX - XT8 Tri-band AX6600

WiFi 6

coverage up to

5500sq.ft 6+rooms

ZenWiFi AC - CT8 Tri-band AC3000

coverage up to

5400sq.ft 4+rooms

*Actual data throughput and coverage will vary from network conditions and environmental factors.

CONTENTS

APC481 JUNE 2020

40 years of talking tech

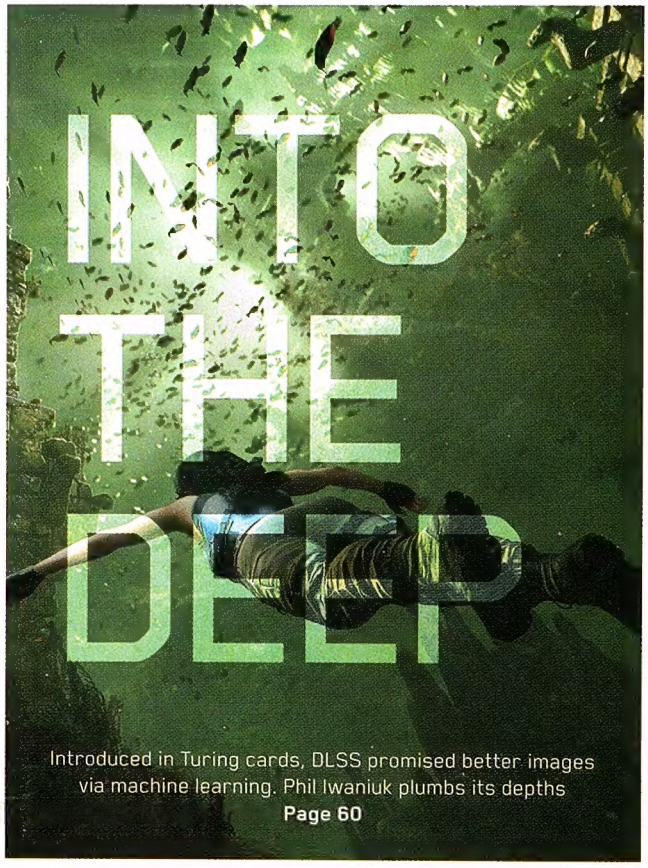
In May 1980 *Australian Personal Computer* was launched, just as the early PC was taking its first shape. Former writers and editors recall the tech and the times, the hits and the misses, and what it was like working on *APC* during their tenures.

Page 31

10 free apps you can't live without

Everybody – and we mean everybody – needs this collection of free tools and apps for their PC

Page 68



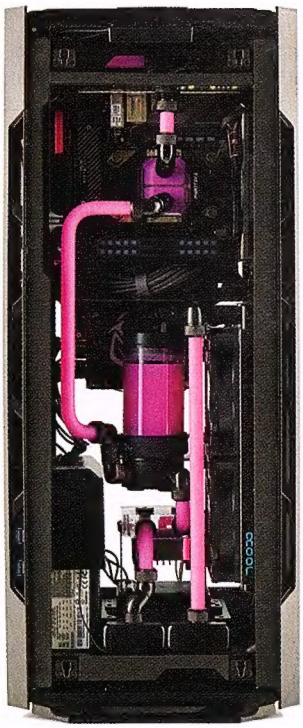
Introduced in Turing cards, DLSS promised better images via machine learning. Phil Iwaniuk plumbs its depths

Page 60

TP Link Deco X60
Page 45

Apple MacBook Air 2020
Page 43

MSI Prestige 14
Page 44



Masterclass: The gaming & media tower
Page 82

Gadgets: Fitbit Charge
Page 26

Downtime: Machine of the month
Page 112

Technotes

10 News
All the big news in tech

14 Tech brief
Raspberry Pi used to power coronavirus ventilators

26 Gadgets
Lovely little bits and pieces

16 End user
To Zoom or not to Zoom? Privacy is the question

18 Two bits
My first PCs

17 Random access
How safe is COVIDSafe?

19 Tech Talk
AMD and the road ahead with Zen 3

20 Open Source
Working from home?

24 The List
Best keyboards in 2020

28 Head to head
Membrane vs mechanical vs optical keyboards

Features

31 40 years of talking tech
In May 1980 *Australian Personal Computer* was launched, just as the early PC was taking its first shape

51 The first 30 minutes with your new PC
Treated yourself to a new computer? Nick Peers reveals how to get it up and running

60 Into the deep
Introduced in Nvidia Turing cards, DLSS promised better images via machine learning

68 10 free apps you can't live without
Everybody – and we mean everybody – needs this collection of free tools and apps

PC Builder

78 System News
79 Market Watch
80 Blueprint
82 Masterclass: Gaming & media tower

The lab

42 Asus Zephyrus G14
43 Apple MacBook Air 2020
44 MSI Prestige 14
45 TP Link Deco X60

Software

46 Windows
48 Apple Mac
49 Linux software

How to

88 Quick tips
We fix your tech problems

90 Windows
Enable G-Sync on a FreeSync monitor

92 Macintosh
Take control of your inbox

94 iOS
Make more of Contacts

96 Linux
Monitoring systems made easy

Masterclasses

98 Raspberry Pi
Light up your life with Sense HAT

100 Power supplies
Understanding PC power supply units

Downtime

102 Gaming news
What's happening in the world of fun

104 Gaming reviews
High-performance playtime

108 Game changer
Star Trek: Bridge Commander

112 Machine of the month
The Commodore Amiga 500

114 Chip chat
Quirky news from the world of geekdom

TP-Link Deco AX3000
Mesh Wi-Fi system
A Wi-Fi mesh for mega mansions
apc
HOT
PRODUCT
APC HOT PRODUCT
When a reviewed product scores 4.5 out of 5 or higher, it carries the Hot Award. These are products that exceed expectations and deliver a quality experience up there with the very best.
apc
RECOMMENDS
APC RECOMMENDS
You will see this award if a reviewed product has scored four out of five stars. It means most people can expect satisfying performance from the product, and that we would use it ourselves.

Inside *APC*

Find out all about *APC*'s editorial policies, test practices, how to read the benchmark results, and more.

APC is Australia's oldest consumer technology magazine – having been consistently in print for forty years, since our first issue way back in May 1980 – and we take that heritage and responsibility very seriously. While our focus is obviously on the personal computer the very definition of the PC has changed and shifted markedly since the early 1980s. As such, we touch on many other areas of tech, too, from smartphones and apps to peripherals, accessories, and beyond. We have two goals: to find the best modern tech and to help you make the most of it.

We're also an open church in terms of platforms. We know most people aren't wed to a single brand's products and use a variety of devices. And, like you, *APC*'s journalists want to know what's good in tech – no matter what platform it resides on.

Independent reviews

Championing technology doesn't mean we're unrelenting yes-men and -women, however, and *APC* aims to be as objective as possible in all our coverage. That means identifying the best products from multiple perspectives – the best performance, best value and best features and, ideally, the products that offer the best mix of these three attributes.

As a matter of policy, reviews published in *APC* are not shared with product-makers prior to print. We will contact vendors under certain conditions; for example, if we have a problem testing a product that seems to indicate it may be faulty, or to invite a vendor to clarify how a particular feature works. If an *APC* reviewer has any potential conflicts of interest involving a brand, the review will always be assigned to another writer.

"APC strives to conduct the most rigorous, objective scientific tests and benchmarks we can so as to make our reviews as unbiased as possible."

Labs testing

APC strives to conduct the most rigorous, objective scientific tests and benchmarks we can so as to make our reviews as unbiased as possible. We use a variety of tools and programs for this, including many freely available benchmark suites for assessing media encoding, general system performance including storage read and write speeds, gaming and battery life.

In most cases, for the benchmark results published in *APC*, you can assume that higher is better. There are certain tests that deviate from this rule where the opposite is true; in those cases, we've flagged the results with a note explaining as such.

We use both tables and graphs for displaying results; the latter offers better ease-of-readability, but tables are more compact, so we use these in most cases where thoroughness is preferred.

WLAN MESH

Mesh WiFi with FRITZ!

The FRITZ!Box 7590 or 7530 and FRITZ!Repeater 300 are a dream team for your home network. Together they bring WiFi into every corner of your home. They route WiFi traffic intelligently, ensuring excellent network coverage for all your devices at home or in the office.

- More Wi-Fi in every room
- One network for all devices
- An intelligent system for consistently strong signal
- DSL, telephony and Smart Home on board
- Easy and flexible to expand
- Easy to use and smart apps

Wi-Fi at home is the best! But it's not so great when reception is weak in some rooms. The solution? Mesh networking at home with FRITZ!.

The FRITZ!Box 7590 or 7530 and FRITZ!Repeater 300 is the perfect soltution for medium-size apartments/ houses on one to two floors

First International Trading Pty Ltd
35/7-9 Percy Street, Auburn NSW 2144

Phone: (02) 8318 3777
Email: sales@firstint.com.au

firstint.com.au

CPU NEWS

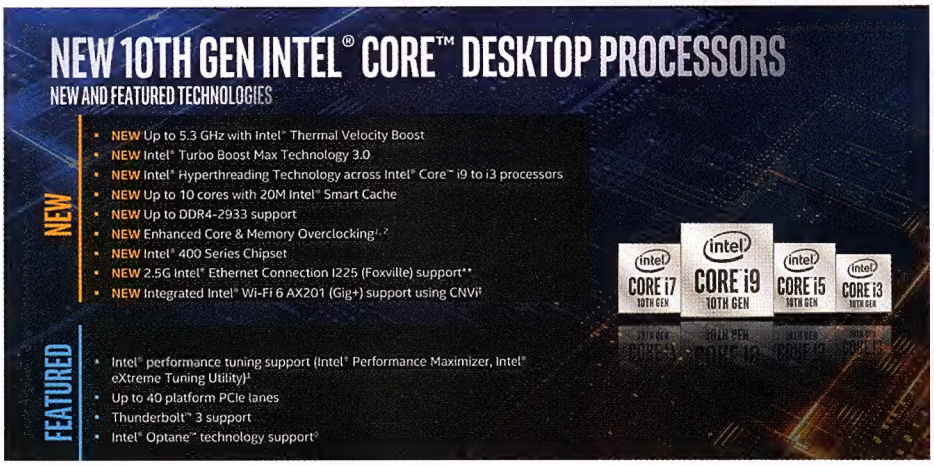
Intel launches its 10th-gen Comet Lake desktop CPU range

More threads and higher clocks at every price point, but is it enough?

Intel has unveiled its 10th-generation Core CPUs for desktop, codenamed Comet Lake-S. The new range is an evolutionary upgrade of the 9th-generation range, with the headline improvements being higher clock speeds, improved overclocking control, a rebalancing of the range to offer better value, and a higher thread count at each respective price point.

The flagship Core i9-10900K (KF models come without graphics) features 10 cores and 20 threads, up from the eight and 16 of the 9900K. Clock speeds have also been increased, with up to 5.2GHz now possible, or 5.3 for a short duration if the system cooling allows it. At US$488, it is priced to compete against AMD's 12-core Ryzen 9 3900X.

Budget-minded users will be pleased to note that the entire Core range, including the i3 and i5 models, all feature hyperthreading. With the i3-10100 featuring four cores and eight threads and a clock speed of up to 4.3GHz, i3 buyers will have performance that rivals Intel's flagship parts, including the i7-7700K from just three years ago. Pricing also appears to be attractive, with the i3-10100 and i3-10300 priced at US$122 and US$143 respectively. We'll have to test against AMD's new quad core Ryzen 3100 and 3300X models to know just how they stack up, though.


NEW 10TH GEN INTEL® CORE™ DESKTOP PROCESSORS
NEW AND FEATURED TECHNOLOGIES
NEW
NEW Up to 5.3 GHz with Intel® Thermal Velocity Boost
NEW Intel® Turbo Boost Max Technology 3.0
NEW Intel® Hyperthreading Technology across Intel® Core™ i9 to i3 processors
NEW Up to 10 cores with 20M Intel® Smart Cache
NEW Up to DDR4-2933 support
NEW Enhanced Core & Memory Overclocking
NEW Intel® 400 Series Chipset
NEW 2.5G Intel® Ethernet Connection I225 (Foxville) support**
NEW Integrated Intel® Wi-Fi 6 AX201 (Gig+) support using CNVi
FEATURED
Intel® performance tuning support (Intel® Performance Maximizer, Intel® eXtreme Tuning Utility)
Up to 40 platform PCIe lanes
Thunderbolt™ 3 support
Intel® Optane™ technology support
CORE i7
CORE i9
CORE i5
CORE i3
10TH GEN

With few differences architecturally over the 9th-generation range, Intel is keen to emphasise the gaming prowess of the range, along with its overclocking capabilities. We'll have to wait and see how the new models overclock, but given the high clock speeds and strong gaming capabilities of 9th-gen CPUs, we're sure that gaming performance will continue to be a bright spot for Comet Lake. We expect that the 10700 and 10600 models will offer very good gaming performance at reasonable prices.

10th-generation CPUs feature an improved cooling design over 9th-gen processors. This is due to the introduction of a thinner die and a higher copper content IHS. With Intel's 14nm process being pushed to its limits along with higher TDP ratings – up to 125W for the higher end models – there's no doubt that overclocking Comet Lake K CPUs will require very strong cooling solutions. Maintaining the higher Turbo clock speeds will likely require quality cooling, too.

Intel continues to improve performance in the premium market segment, with new Turbo Boost modes enabling up to 5.3GHz in short bursts.

Accompanying the new CPUs are motherboards with the Z490 chipset, which comes with a new LGA 1200 socket. Current LGA 1151 coolers are compatible. The platform offers official DDR4-2933 support, Wi-Fi 6, and many motherboards will include Intel's i225 2.5G Ethernet controller.

Intel has faced issues with 14nm supply in recent quarters. We're hoping this won't impact Comet Lake availability as the new range launches. There's also the looming threat of AMD's Zen 3-based processors due later in the year. We'll be back with a full review of Intel's 10th generation CPUs and Z490 motherboards in the next issue of *APC*.

INTEL 10TH-GEN COMET LAKE DESKTOP CPUS

CPU	BASE CLOCK SPEED (GHZ)	TURBO BOOST 2.0 MAXIMUM (GHZ)	TURBO BOOST 3.0 FREQUENCY (GHZ)	THERMAL VELOCITY BOOST SINGLE / ALL CORE TURBO (GHZ)	ALL CORE TURBO FREQUENCY (GHZ)	CORES/ THREADS	PCIE 3.0 LANES	PRICING (USD 1K)
I9-10900K	UP TO 3.7	UP TO 5.1	UP TO 5.2	UP TO 5.3 / 4.9	UP TO 4.8	10/20	UP TO 40	$488
I9-10900KF	UP TO 3.7	UP TO 5.1	UP TO 5.2	UP TO 5.3 / 4.9	UP TO 4.8	10/20	UP TO 40	$472
I9-10900	UP TO 2.8	UP TO 5.0	UP TO 5.1	UP TO 5.2 / 4.6	UP TO 4.5	10/20	UP TO 40	$439
I9-10900F	UP TO 2.8	UP TO 5.0	UP TO 5.1	UP TO 5.2 / 4.6	UP TO 4.5	10/20	UP TO 40	$422
I7-10700K	UP TO 3.8	UP TO 5.0	UP TO 5.1	NA	UP TO 4.7	8/16	UP TO 40	$374
I7-10700KF	UP TO 3.8	UP TO 5.0	UP TO 5.1	NA	UP TO 4.7	8/16	UP TO 40	$349
I7-10700	UP TO 2.9	UP TO 4.7	UP TO 4.8	NA	UP TO 4.6	8/16	UP TO 40	$323
I7-10700F	UP TO 2.9	UP TO 4.7	UP TO 4.8	NA	UP TO 4.6	8/16	UP TO 40	$298

CORSAIR
GAME IN THE FAST LANE
UP TO 60FT
SLIPSTREAM
CORSAIR WIRELESS TECHNOLOGY
Up to 60ft of wireless range
Sub-1ms latency
Multiple devices, just one receiver

CPU NEWS

AMD's budget Zen 2 processors finally arrive

Are the Ryzen 3 3100X and 3300X the new budget kings?

AMD has launched its Ryzen 3 3100 and 3300X CPUs, rounding out its Ryzen 3000 range. Ryzen 3000 CPUs have been very well received but budget models have been absent from the market until now. Both CPUs are built on the same Zen 2 architecture as the higher end models, and bring four-core and eight-thread computing to all but the very cheapest PCs.

The Ryzen 3 3100 features a 3.6GHz base clock and a 3.9GHz boost clock. At just US$99 for an eight-thread processor, it looks like a genuine game changer at the low end of the market. The 3300X has a higher 3.8GHz base clock and a 4.3GHz boost clock. It too offers tremendous value at US$120. Both CPUs come with the added value of a Wraith Stealth cooler. Both models feature 18MB of level 3 cache, a thrifty 65W TDP and feature unlocked multipliers for easy overclocking. They don't have integrated graphics however.

Both models follow AMD's multi chip module design philosophy. On the surface both CPUs differ only by their frequencies, however their core topology is different, with the 3100 having a '2+2' configuration compared to the '4+0' configuration of the 3300X. This means the 3300X should have an extra performance benefit and lower latency.

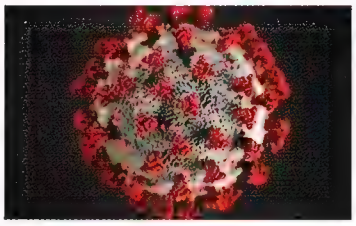
The strong IPC of the Zen 2 architecture should mean the 3100 and 3300X will be highly competitive with Intel's offerings as well as flagship quad core designs of yesteryear. In fact AMD believes the 3300X beats out the Intel i7-7700K in many applications, including gaming, while running cooler and using less power. We'll test that for ourselves, but if that that claim holds true then AMD certainly deserves credit.

INTRODUCING THE NEW AMD B550 CHIPSET
ENTHUSIAST CLASS FEATURES STARTING AT $100 USD
PCIE® 4.0 FOR EVERYONE
For NVMe storage and Graphics Cards
DUAL CPU SUPPORT
PCIE® 3.0 GENERAL PURPOSE LANES
AVAILABLE JUNE 16th, 2020
B550

Also launched was AMD's budget B550 motherboard chipset, which brings PCIe 4.0 SSD speeds to cheaper platforms.

AMD also announced the highly anticipated B550 chipset, which brings features such as PCI Express 4.0, USB 3.2 Gen 2 and dual GPU support to the budget market. These motherboards are due for release in mid-June with all manufacturers having several models in development.

Both the 3100 and 3300X will compete against Intel's new Core i3-10100 and i3-10300 models. It will be interesting to see which company comes out on top in this latest battle of the CPU wars.



Folding@Home now has dedicated Coronavirus research option

UPDATE ADDS AN OPTION FOR DONATING TO COVID-19 RESEARCH SPECIFICALLY.

Folding@Home allows people to donate extra CPU and GPU cycles to researchers fighting diseases, including COVID-19, from home. But there hasn't been an option for users to select COVID-19 researchers specifically as the recipient of their efforts. Now, Folding@Home has added the priority option in its latest update.

Previously, there were five options in the web interface for which diseases you could help fight: any disease, Alzheimer's, Cancer, Huntington's and Parkinson's disease. The way to contribute to COVID-19 research was by selecting "Any disease" and hoping you'd get assigned work for your cause. Folding@Home assured users that most of the resources sent to "Any disease" would get put towards fighting COVID-19, but it left many users confused.

Google may ditch Qualcomm and use its own chipsets

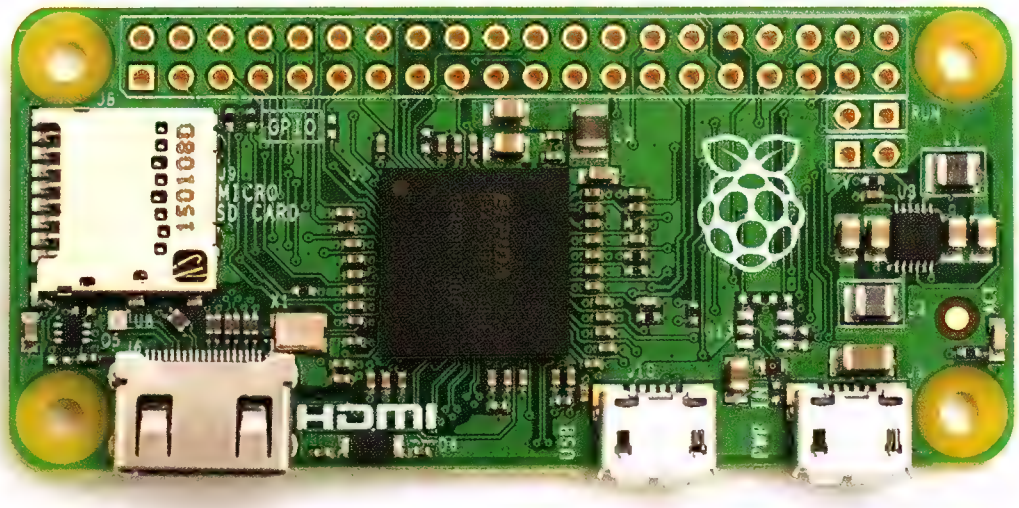
IS GOOGLE WORKING ON CUSTOM CHIPSETS FOR THE 2021 PIXEL LINEUP?

Google has been linked with making custom chipsets to power its phones for a while now, and a new report from *Axios* suggests it made "significant progress" in developing its own chipset. It's claimed Google may use its in-house solution as early as 2021, and could even end up on Chromebooks.

Axios says Google developed the chipset – which is codenamed Whitechapel – in partnership with Samsung, and the custom design is set to be manufactured on Samsung LSI's 5nm manufacturing node. This year's Qualcomm Snapdragon 865 chipset is built on a 7nm node, and a shrink to the 5nm node is likely for next year's designs. ■

1. Testing done by AMD performance labs for Radeon RX 5500 XT on November 20, 2019 on the following games with the following settings: Borderlands 3 (High), Rocket League (High). PC manufacturers may vary configurations yielding different results. Performance may vary. RX-403

© 2019 Advanced Micro Devices, Inc. All rights reserved. AMD, the AMD Arrow logo, Ryzen, Radeon and combinations thereof are trademarks of Advanced Micro Devices, Inc. Other product names used in this publication are for identification purposes only and may be trademarks of their respective companies.



TECH BRIEF

Raspberry Pi to power ventilators as demand for boards surges

The $10 Pi Zero will be the brains of life-saving devices.

A little slice of Pi could play a big role in the fight against Coronavirus. The Raspberry Pi Foundation is ramping up production of the Raspberry Pi Zero because ventilator manufacturers are using the $5 computer to power their life-saving devices. Demand for all Raspberry Pi Models has surged in recent weeks as people use the inexpensive computers for tasks such as remote learning and doing maker projects at home.

As the need for ventilators grows, manufacturers are looking for control boards to serve as the brains of their devices. Recently, Intel was reportedly asked to produce 20,000 Broadwell processors to meet demand from medical companies. Because of its production abilities, Raspberry Pi Foundation is able to provide those orders quickly.

"One of the main challenges with rapidly scaling manufacture of products like this is that you may be able to surge production of the air-handling elements, but you still need to provide the control element: often the components you need are on 20-week lead times and (hopefully) we'll be out of the other side of this pandemic by then," said Eben Upton, CEO and Founder of Raspberry Pi. "Raspberry Pi 'builds to stock' rather than 'building to order,' so we generally have products either on-hand or in the pipeline with short lead times."

Even though Raspberry Pi builds to stock, the organisation has still experienced a shortage of Raspberry Pi Zero Units, due to demand from consumers as well as the foundation's desire to hold stock for ventilator manufacturers. Upton says that the organisation produced 192,000 Zero-line (Pi Zero / Zero W) products in Q1 but plans to increase that number to 250,000 going forward.

If you're familiar with Raspberry Pi, you know that the Pi Zero is actually the least powerful current device in the organisation's lineup. It features a single-core, 1GHz Broadcom BCM2835 CPU with 512MB of RAM while the Raspberry Pi 4 B has a quad-core CPU and 2GB (or 4GB). So why are medical companies going for the cheapest option? Upton believes that it has to do with the low-scale compute needs for ventilators and the board's small size.

"I believe the interest in Zero is mostly down to it offering enough compute for the relatively modest requirements of a ventilator"

"I believe the interest in Zero is mostly down to it offering enough compute for the relatively modest requirements of a ventilator (potentially control air-handling components at fairly low frequency, handle a simple user interface)," Upton told us. "Although I know some of the approaches out there (not sure if we're engaged with any of these) aim to scale production of the sort of lightweight ventilator they use in ambulances, so size may also be a factor."

Upton said that, to his knowledge, this is the first time that Raspberry Pi boards have been used in medical devices. In late April the *BBC* reported that two hospitals in Colombia are set to test Pi-powered ventilators in the future.

Aside from its nascent place in the medical equipment space, Raspberry Pi sales are booming, with 1.75 million units shipped in the first quarter alone. Upton says this increase in demand is due to consumers using them for home schooling, and organisations using them for telecommuting. For example, in the UK, a shortage of laptops has caused the NHS to provide Raspberry Pi units to its remote workers. ■

AORUS

IT TAKES A HERO TO MAKE A HERO

CS:GO World's top E-sports Team, G2 Esports Certified

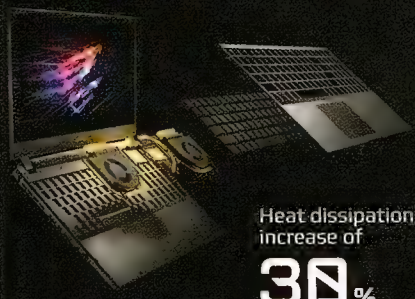
AORUS 15G

The Slimmest Laptop with

Mechanical Keyboard

240Hz

intel CORE i7 | intel CORE i9 | GEFORCE RTX | RTX-IT S ON | BSKL omron | reddot winner 2020



WINDFORCE infinity

Heat dissipation increase of **30%**

Mechanical Switches

Actuation point of **1.6mm**

Keystroke Lifespan **15 Million**

Gaming Display Panel

REFRESHES SO FAST YOUR EYES WON'T BELIEVE IT'S A GAME.

240Hz **NTSC 72%**

https://www.instagram.com/gigabytenb_anz/ | www.gigabyte.com/au/Laptop

END USER

To Zoom or not to Zoom? Privacy is the question

The sudden rise of video conferencing in pandemic times has been turbulent, to say the least, writes Shaun Prescott.

For those lucky enough to work from home during the COVID-19 pandemic, video conferencing has become a central part of our lives. While many have used the likes of Google Meet and Microsoft Teams for ages, somehow a lesser known video conferencing app called Zoom has become the go-to service in 2020 – so much so that the word Zoom itself has become shorthand for video chat.

The app's star rose unexpectedly in February, but it wasn't long before experts started to poke around. In late March, *Motherboard* found that Zoom was secretly sharing data with Facebook – even for users without a Facebook account. After this report was published, Zoom disabled the sharing, which it maintains did not involve personal data.

Other controversies followed: the app was found to not implement end-to-end encryption, which the company says has been addressed in an April update. Elsewhere, it was found to have hidden data-mining features, and its calls were found to be "mistakenly" routed through Chinese servers. Some states in the US have outright banned the use of Zoom for at-home schooling due to ongoing privacy concerns, and as of writing, three class action lawsuits have been filed against the company. The Pentagon has forbidden use of Zoom's free service (though it uses the paid service Zoom for Government).

Late in April, *ABC News* in the US obtained a federal intelligence analysis which warned the software could be used for foreign government surveillance. Zoom arced up in a statement, describing the analysis as "heavily misinformed, includes blatant inaccuracies about Zoom's operations, and the authors themselves admit only 'moderate confidence' in their own reporting."

The service has also birthed a culture of Zoombombing, where trolls and hackers access random video conference calls to spam them with pornography and abuse. Meanwhile, zWarDial has emerged – a small piece of software used by Zoombombers to auto-detect Zoom meetings that aren't password protected. On the dark web, a small trade has blossomed in the sale of compromised Zoom accounts, according to a report on *Bleeping Computer*.

SHAUN PRESCOTT
Author, PC gamer and passionate technology observer, Shaun covers trending tech topics for *APC*.

"The service has also birthed a culture of Zoombombing, where trolls and hackers access random video conference calls to spam them with pornography and abuse."

Zoom was founded in 2011 in California. While mainstream use of the service is free and fairly straightforward – nothing you couldn't do using Google – its business-centric features, such as large scale conferencing, contributed to it having a US$1 billion valuation in 2017. It's possible the service's pandemic-buoyed ascent took the company a little by surprise, as it's traditionally been marketed as a business solution.

Houseparty is another video conferencing app that has seen growth during the pandemic, though definitely on a lesser scale than Zoom, and almost never as a business-centric tool. In March it was accused of hacking its users Netflix, PayPal and Spotify accounts, as reported by *The Independent*. Houseparty has strongly denied these claims, going so far as to offer a US$1 million dollar bounty to anyone who can find proof of a "smear campaign" against the company, which is owned by Epic Games.

More generally, increased use of video conferencing appears to be slowly shaping the way we engage with the technology. The use of decorative conferencing backgrounds has been made mandatory by some schools, to protect the privacy of children and their families, and there's a small trend in users being castigated online for embarrassing telling details in their offices. Whatever the case, it's fair to say that 2020 will prove to be a pivotal time in shaping the way we use video conferencing into the future. ■

RANDOM ACCESS

How safe is COVIDSafe?

Will global contact tracing apps designed for containing the coronavirus mark the end of location anonymity?

Australia launched its COVIDSafe contact tracing smartphone application on Sunday April 26th and within the first five hours of it being available more than a million people had downloaded it. That so many people downloaded this software is a feat on its own, but this application is one of the first of its kind (at least we hope) to keep track of the population's movement using an encrypted identification number in a way that links directly to your medical records. A few years ago the debate about legislation to require telecom companies to keep your metadata (the location, time and numbers of your calls and texts) for two years was in full swing with privacy advocates suggesting that this is enough information to track your day to day movements. Fast forward to today and metadata looks relatively quaint in contrast to what the COVIDSafe app could do if not managed appropriately.

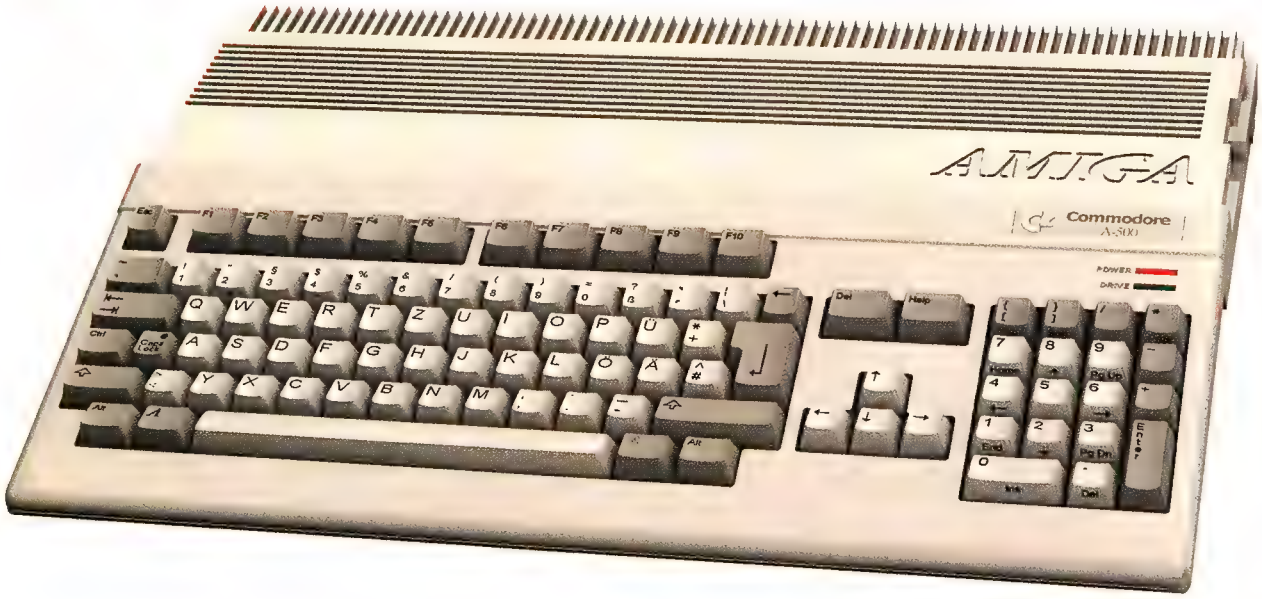
Fortunately the Australian government seems to be responding to privacy concerns appropriately and many who have looked into the code seem to think the data the app collects is relatively benign. Basically, the COVIDSafe app will use Bluetooth to identify other devices that it comes in range of (15m) and simply logs an encrypted identification number for that device. If you get multiple logs from one other device over a timespan of more than 15 minutes the app marks this as a contact and will save this identification number for 21 days (the accepted estimated incubation period of COVID-19). The app doesn't actually log any location data, it simply traces its proximity to other devices and while it may prompt you to allow location data access permissions on Android phones, this seems to be an Android fault that just bundles the questions of Bluetooth access and location data permissions into one permission setting.

JOEL BURGESS
When not reviewing PCs for *APC* and writing our funny pages, Joel likes to ponder tech and how it's used.

Of course, if this technology did also take note of location data it would be a very similar system to what Tile trackers use, pairing proximity to a phone and using its location and orientation data to estimate the exact tracker location. Thankfully Federal Health Minister Greg Hunt has said that the government would release the source code within a few weeks of launch. A number of third party engineers had reengineered the code for the app ahead of this and confirmed that the app doesn't collect location data and deletes encrypted logs after 21 days, which ensures that this data cannot be stolen and used inappropriately by hackers to retrace your steps.

If lots of Australians download it, it'll actually mean illness containment can happen through tracing rather than the blanket preventative measures of shutting down public spaces. We still can't see bars and restaurants opening up anytime soon, but with this kind of technology and good hygiene then it should be easy enough to contain this virus while winding back many of the lockdown measures. ■

"A number of third party engineers had reengineered the code for the app ahead of this and confirmed that the app doesn't collect location data and deletes encrypted logs after 21 days, which ensures that this data cannot be stolen and used inappropriately by hackers"



TWO BITS

My formative years

A lifetime of PC greatest hits.

Can you believe that *APC* has been around for 40 years? I was the tender age of one; PCs and technology weren't that high on my priorities back then, but oh boy did that change over the coming years!

My first computing experience was with a Commodore 64, complete with its cassette tape drive. To be honest I don't recall too much of my user experience with it, beyond sinking hours into games such as *Bubble Bobble* and *Boulder Dash*. What came next was a machine that really got me into computing, the mighty Amiga 500.

The Amiga 500 ignited my love of gaming, and to this day many Amiga games remain on my best-of list. Playing games like *Lemmings*, *Prince of Persia* and *Turrican* left me with truly fond memories from a happy time. I was convinced that the Amiga would become a de facto home computer architecture and had many an argument with a friend who was a budding PC enthusiast. It was around 1993 and I believe he had a 386 PC but I was sure that my beloved Amiga 500 was better. You were right, Mikey.

It was 1994 or 1995 when I convinced my dad that I needed a PC, for study purposes of course! That magical 486 machine came with a CD-ROM, and included a Microsoft Encarta disc. Fancy having an entire encyclopedia on a single disc! I believe that PC was a 486DX or SX. I very fondly recall playing all time classic games such as *TIE Fighter* and *Links* golf. To this day I have a love of golfing sims. The upgradeability of PCs and my wish for better gaming performance lit a spark in me that continues to this day.

As a teenager, I used the family PC. After finishing study and finally having some money, my first personal build was an AMD Athlon 2600+ with an Asus A7N8X Deluxe. I don't think I was ever really happy with that system, but it did allow me to tinker with overclocking for the first time. I loved the next one, a Pentium 4 2.8C Northwood system paired with a fondly remembered Abit motherboard. Overclocking yielded truly impressive and tangible results in those days, and my love of OC firmly took hold.

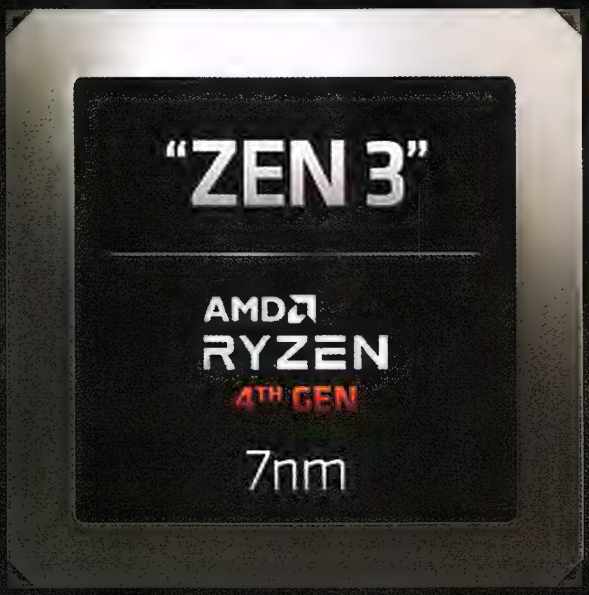
Overclocking became a full on hobby, progressing from the Pentium 4 to the legendary AMD Opteron 165. I sank way too much money into Intel Q6600, E8600 and onwards to Nehalem and Sandy Bridge systems. I got hooked on extreme overclocking with the discovery of HWBOT in about 2007. I spent $3,000 on a custom-made, dual-stage cooler that could hold a processor under full load at -100C. I spent many an hour using that cooler, along with liquid nitrogen, endlessly navigating BIOS settings and looking for ways to squeeze out a few extra MHz.

My love of PCs and technology continues unabated. Even now I'm like a kid in a candy score when one of the vendors sends me an email about an upcoming product. I run all those old HWBOT benchmarks every time, and regularly load up an older game, or watch a Youtube long-play and marvel at just how far things have come, and wonder where we're going. Let's hope *APC* gets to the half century and beyond! ■

"That magical 486 machine came with a CD-ROM, and included a Microsoft Encarta disc. Fancy having an entire encyclopedia on a single disc!"

CHRIS SZEWCZYK
A life-long PC tech enthusiast, Chris has worked acoss the industry in many areas as a product and technology expert.

"Having a simplified building block that can be repeated as needed is great for scaling to higher core counts, and it reduces time to market and overall chip complexity."



TECH TALK

Still rising

Zen 3 aims to keep AMD's CPU momentum rolling.

Over the past several years, AMD's CPU team has been firing on all cylinders. Or cores... It has pushed Intel in ways that were almost forgotten. And AMD is not letting up on the pressure, either. In its recent Financial Analyst Day briefings, AMD went into detail about its plans for the next several years of CPU and GPU advancements.

The most important bits: Yes, Zen 3 and fourth-gen Ryzen CPUs are coming and should launch before the end of the year. Plus, RDNA 2 and Navi 2x GPUs with ray-tracing capabilities will also arrive before 2021. I'm going to leave the GPU discussion for another day and focus on the Zen 3 CPUs.

First, Zen 3 will continue to use TSMC's 7nm FinFET manufacturing process. There were earlier rumours that it would switch to TSMC's N7+ Extreme Ultraviolet (EUV) node – and it still might – but AMD has stopped referring to it as "7nm+" and now just calls it 7nm. That doesn't mean it's the same node as Zen 2, however, as TSMC has a newer second-gen N7P "performance-enhanced" node available that sticks with Deep Ultraviolet (DUV).

N7P is design compatible with the original N7, but optimisations allow TSMC to deliver either seven percent higher boost performance (clock speeds) at the same power, or keep the same performance and reduce power use by 10 percent. N7+ is not design compatible, but offers larger potential gains: It allows for 15–20 percent better density than N7, so more transistors can be crammed into a chip, or chips can be smaller. Whether it uses EUV N7+ or DUV N7P, Zen 3 should see at least modest improvements on the silicon side of things.

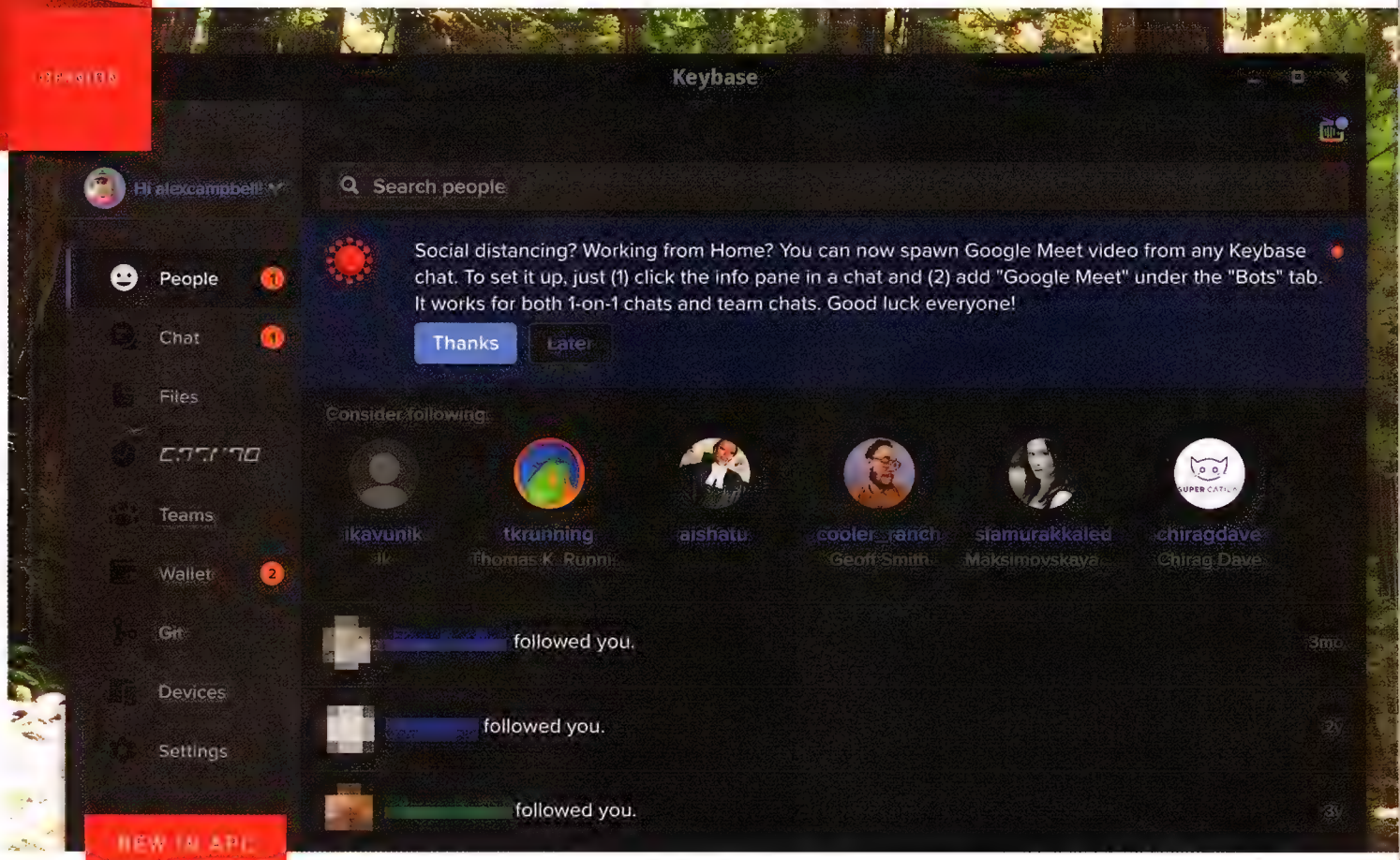
AMD will also be updating the base architecture, as it always does, but it hasn't revealed too many details. Most of what we know comes from the data center side of things, where the 7nm Zen 3 "Milan" CPUs will feature a modified Core Complex (CCX) compared to previous Zen architectures. The biggest change is that instead of having two four-core CCX partitions in a chiplet with 16MB of L3 cache each, Zen 3 will have a unified eight-core CCX with a shared 32MB L3 cache. That's important as it should improve latency and memory throughput, which improves performance.

Going back to the original Zen architecture, AMD's CCX has been both good and bad. Having a simplified building block that can be repeated as needed is great for scaling to higher core counts, and it reduces time to market and overall chip complexity. It's a major part of why AMD was able to launch eight-cores with first and second-gen Ryzen, then up to 16-cores with third-gen Ryzen. However, the partitioned L3 cache CCX approach does add latency to any cache accesses that have to cross from one CCX to the other. Zen 2 helped overcome this by doubling the L3 cache size, and Zen 3 will improve things further by unifying the L3 cache for each chiplet. There will still be added latency for cross-chiplet cache accesses, but the sheer size of the L3 caches will help to combat that.

There are also reports that Zen 3's floating point performance could be up to 50 percent higher than in Zen 2, with instruction per clock (IPC) gains from 8–17 percent, depending on workload.

This is all at the same power requirements as Zen 2. These chips are already easily beating Intel's best when it comes to performance per watt. It desperately needs something better than 14nm+++ CPUs if it hopes to compete. ■

JARRED WALTON
Jarred has been a PC and gaming enthusiast for over 30 years.



OPEN SOURCE

Working from home?

Try these open-source tools.

A lot of workers will be working from home in the coming weeks. As a result, they will rely on communication and collaboration tools as stand-ins for being at their desks or in meeting rooms. There are offerings from the likes of Google, Microsoft, and Zoho, but there are lots of great open-source offerings, too.

A prime contender is Keybase (**https://keybase.io**) and its collaboration tools. While Keybase's first goal is to facilitate easy encryption tools, it offers Slack-like teams and private chat. Keybase also offers private, encrypted online file storage (like Dropbox) that can be shared with individuals or teams. Keybase recently added a Google Meet bot, which when invoked with "!meet" creates a link to a Google video conference.

Slack and Atlassian's HipChat are big players, but to get the most out of them, you have to pay. There are two more platforms worth a mention, though. Rocket Chat (**https://rocket.chat**) and Mattermost (**https://mattermost.com**) are self-hostable Slack replacements available under the MIT license. The basic features (such as unlimited chat history) are free; enterprise licenses are required for more advanced features. Both have apps for iOS, Android, Linux, MacOS, and Windows.

For file-hosting, Nextcloud (**https://nextcloud.com**) has long been a staple solution. It offers a suite of plugins in addition to file-hosting and sharing capabilities. Plugins and features include team chat, calendars, notes, contact management, and more. For larger teams, I recommend hosting Nextcloud on a reasonably fast server and using a MySQL database instead of the default SQLite database back end. One of my favorite things about Nextcloud is the ability to use a ton of different storage back ends for files, including Google Drive, Amazon S3-compatible object storage, and more. I've had mixed results with its Android and Linux desktop clients, which can be buggy.

If you just need file storage and sync without the extra features of Nextcloud, SparkleShare (**https://sparkleshare.org**) offers a solid file-sharing and sync option. Both SparkleShare and Nextcloud can encrypt files at rest, so your files are only available via the application. This means that if your remote storage is compromised, your files remain unreadable.

ALEX CAMPBELL
Alex is a Linux geek who enjoys learning about computer security.

For video conferencing, Google's Hangouts and Microsoft's Skype are big players, as is Zoom, which, depending on your experience, is either great or terrible. One of the open-source tools that can replace those services is Jitsi (**https://jitsi.org**). It isn't a standalone app, but a secure video-conferencing solution for other projects. Rocket Chat uses Jitsi to implement its video-conferencing capabilities.

Finally, I'd like to throw in plain old Git (with GitHub, GitLab, or another remote host). It's a great collaboration tool for text-based files. If your work lends itself to plain-text formats (Markdown, Restructured Text, HTML, LaTeX, etc.), consider using Git instead of the common filename madness of "document.doc," "document-1.doc," "document-1-final.doc," and so on.

There are a lot of open-source tools to help get work done while away from the office. Stay safe and healthy out there. ■

BILLION®

Eusuring Business Continuity with Advanced Failover/Failback and VPN

VDSL2 ADSL2+ | Dual SIM | 802.11n | IPv6 Support | Firewall | VPN Security

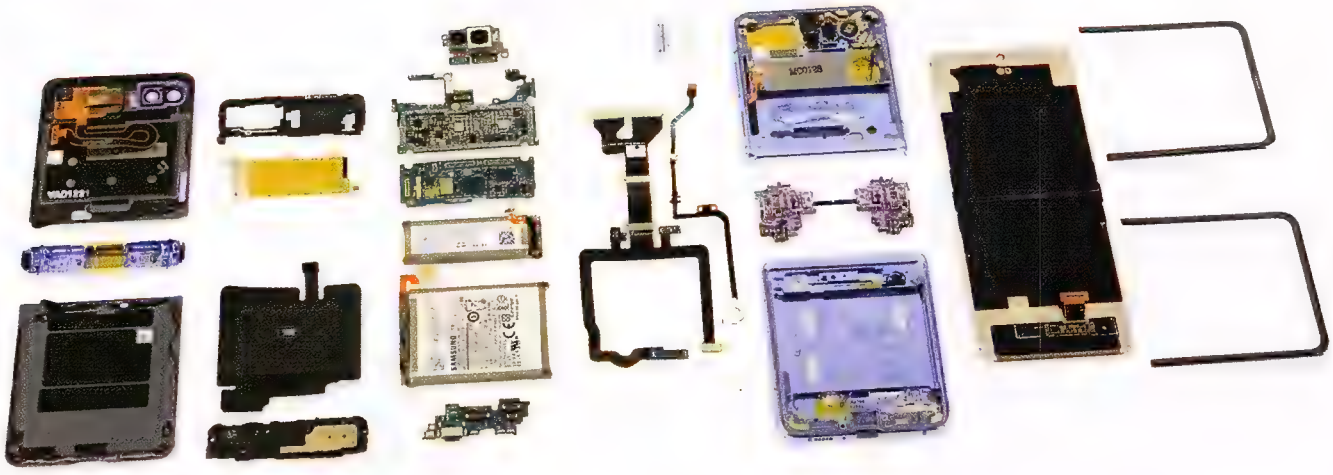
BiPAC 8920NZ CAT.6

M2M Dual-SIM 3G/4G LTE Embedded V/ADSL2+ Wireless-N VPN Firewall Router

- Triple-WAN approach –VDSL2, ADSL2+, 3G/4G LTE or Ethernet WAN for broadband connectivity
- 3G/4G LTE embedded with dual-SIM card slots
- Support LTE CAT 6; up to DL:300Mbps and UL:50Mbps
- Auto Failover/ Fallback feature to ensure an always-on connection
- 16 IPSec VPN tunnels supported

First International Trading Pty Ltd.
Unit 35, 7-9 Percy Street, Auburn NSW 2144
Phone: (02) 8318 3777
Email: sales@billion.com.au
sales@firstint.com.au

au.billion.com



Samsung Galaxy Z Flip

Bendable glass, they say...

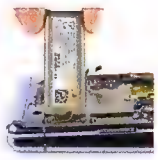
Samsung proudly touted its hot new Galaxy Z Flip's folding glass display and the "layer of fibers" built into its hinge at the company's Unpacked event. We managed to get hold of one, and now it's time to put it to work – for a teardown.

Major tech specs

- 6.7-inch foldable ultra-thin-glass AMOLED Display, 21.9:9 aspect ratio, 2636x1080 pixels (425ppi)
- 2.95GHz, 64-bit, octa-core Qualcomm Snapdragon 855+ SoC
- 8GB of RAM and 256GB of internal storage
- 3,300mAh of battery power in two cells
- Two rear cameras, both 12MP, one ƒ/1.8 wide-angle and one ƒ/2.2 ultra-wide; one 10 MP ƒ/2.4 selfie cam
- "Sweeper technology" made up of a layer of fibers inside the "Hideaway Hinge" to repel dirt and dust

Key findings

- Open the Z Flip, and you'll spot the crease in the display. That glass sure creases like plastic; looks like it scratches like plastic, too! It's not as durable as Gorilla Glass.
- Samsung says that the Z Flip's hinge-sweeping "brushes" use nylon fibers to repel dust, but when you turn it on, you get a litany of warnings. So, we introduce our Flip to some bright purple dust. After a few seconds of heavy dust exposure, opening the phone results in horrible popping noises and a hinge that's frozen solid.
- We remove both rear covers and spot purple dust peeking out from under the wireless charging coil. Peeling up the coil reveals a powdery reminder that you should believe warning text more than marketing hype.
- The Flip packs a dense, double-stacked motherboard. We first saw this space-saving technology in the iPhone X. It makes life harder for board repair experts, but also packs a lot of chips into a tiny space.
- We remove the two batteries. The larger one is limited to a typical capacity of 2,370mAh and 9.15Wh, with the smaller battery sporting 930mAh and 3.59Wh. All that adds up to 12.74Wh, about on par for flagship smartphones. Stubborn glue secures both batteries, as per usual.
- Mild heat and careful prying gradually release the display from its frame. The glue is forgiving, but it's far too easy to accidentally separate the display's layers. The top layer is plastic, which sort of defeats the purpose of a "glass" display. You can tell the middle layer is glass because of the way it shatters when we poke it. Oops.
- Peeling back the hinge's "protective" tape reveals the highest concentration of purple dust. Looks like the tape kept the dust away from the display but held it in the hinge.

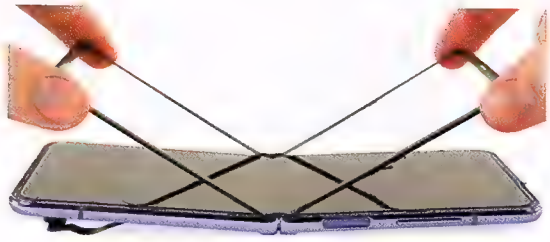


Alcohol and careful prying are required to fetch the batteries out.

Repairability: 2 out of 10 (10 is easiest to repair).

A single Phillips driver takes care of all the screws.

Many components are modular and can be replaced independently. Glued-down glass panels are an unnecessary barrier to entry for repairs, especially given the phone's lack of ingress protection. Battery replacements are possible, but unnecessarily difficult due to poorly routed cables and the lack of stretch-release adhesive. The components involved in the folding process are likely to wear over time, necessitating eventual replacement. ■



Lock Z-foils in attack position! These glued-down plastic bezels guard the primary display.

msi

SUPPORTS intel CHIPSET Z490 intel CORE 10TH GEN

Z490 SERIES MOTHERBOARDS

LEVEL UP WITH MSI

AND SCORE UP TO A **WD NVME SSD** + STEAM GIFT CARD

UP TO $50

UP TO 1TB

REEDEEM AT AU.MSI.COM

T&C'S APPLY. SEE MSI WEBSITE FOR FULL DETAILS.

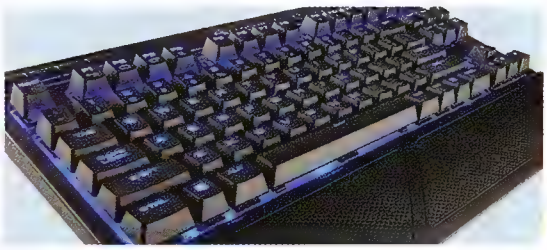
THE LIST

The best keyboards in 2020

08

HyperX Alloy Core RGB

HyperX clearly decided to flex with the Alloy Core RGB, delivering an effective membrane keyboard that looks great for under a hundred dollars.



07

Logitech G Pro X

The G Pro X might appear at first glance to be feature-light, but the inclusion of easily swappable key switches for physical customisation is brilliant.

06

Corsair K63 Wireless

Corsair's high build quality and style make for an excellent wireless keyboard, complete with Cherry MX Red switches and a soft rubber wrist rest.

05

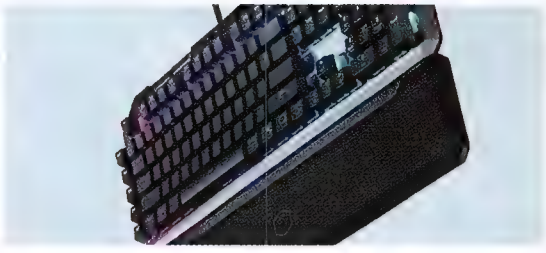
Das Keyboard 4 Professional

Functionality over frills. No key backlighting or dinky touchscreens here, just a solidly designed keyboard, perfect for typists who prefer mechanical keys.

04

Steelseries Apex Pro

A sleek deck with RGB lighting, a tiny OLED display, and incredible customisation, thanks to complete actuation point adjustment on a per-key basis using SteelSeries's own software.



03

Cooler Master MK850

Cooler Master might not be known for its keyboards, but the MK850 is a high-quality mechanical keyboard with all the usual bells and whistles, plus its unique analog key technology.

02

Corsair K95 RGB Platinum

One of the best mechanical keyboards around, this oozes quality. It's a big, expensive setup, with dedicated media controls and textured WASD keycaps. We love it.

01

Razer Huntsman Elite

With Razer's opto-mechanical switches, this has near-instantaneous key response. Using light instead of physical contact pieces means keys are twice as durable as traditional ones. ■

techradar.
The home of technology
techradar.com

GADGETS

NICE THINGS TO HAVE, FOR YOUR PC OR BEYOND

$249, fitbit.com/au

Fitbit Charge 4

New on-board GPS means you can leave your phone at home.

The Charge range has long been our pick for the best value fitness tracker, but the Charge 4 has some exciting new additions that make an upgrade well worth considering. The new update comes with on-board GPS tracking for the first time so you can get mapped exercise info without needing to carry your phone. There's also a new Active Zone Minutes tool that helps you monitor your daily exercise levels by time spent exerting energy rather than by using the less-precise step count measure. These features join the seven-day battery life, Fitbit Pay functionality and 5ATM water resistance for an excellent all-round fitness tracker.

$1,299, dyson.com.au

Dyson V11 Outsize

Bigger bins and hot-swap batteries for larger houses.

While we loved almost everything about the Dyson V11, the battery life was designed for inner-city houses that had a slightly smaller footprint. The new V11 Outsize is a new supersized version of the V11 cyclonic cordless vacuum that is bigger and better in two key areas: battery life and bin size. First, the battery is capable of being hot swapped for another that is already charged to give bigger households up to two hours of continuous cleaning on surfaces like floorboards. The V11 Outsize also comes with more than twice the bin capacity of regular V11 units, to keep you going longer.

US$1,499 (04F), US$1,999 (05F), www.lian-li.com/dk-05f

Lian Li DK-04/05F

Your desk is where everything belongs.

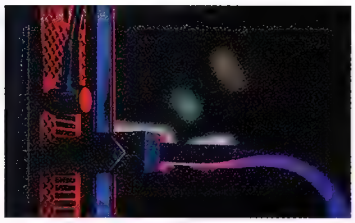
There are motorised standing desks, and they are better than you would expect if you've never enjoyed the pleasure of stretching your legs and have the desk stretch with you. But most do just that. A new pair of desks from Taiwanese co. Lian Li is designed so that you can build an entire PC inside the cavity under the surface – then gaze adoringly at your RGBs when you should really be working. And if you super-size to the 05F model it can hold two complete systems inside. We think the market for these is probably quite small, but for a certain someone this is a dream come true.

$11,399, lg.com/au

LG 4K OLED GX77

Lockdown might be the perfect time to upgrade your TV.

LG's GX 77-inch 4K OLED is just one of many top shelf TVs the company is releasing in the Australian market this year and while it's $11,399 price tag will still look painful for most of us, it isn't quite the $35,999 that a new 77-inch 8K OLED will set you back. All this year's models down to the $3,599 55-inch OLED55BX from LG will get updates to Dolby Vision to include 'Filmmaker Mode' which allows directors to calibrate colours directly for the TV. If that's not enough all the 100Hz models are officially G-Sync compatible, so you can also fire up your favourite PC games.



US$99

www.vivify.cc/product/arquus-w73

Vivify Arquus W73

BECAUSE WHY THE HECK NOT.

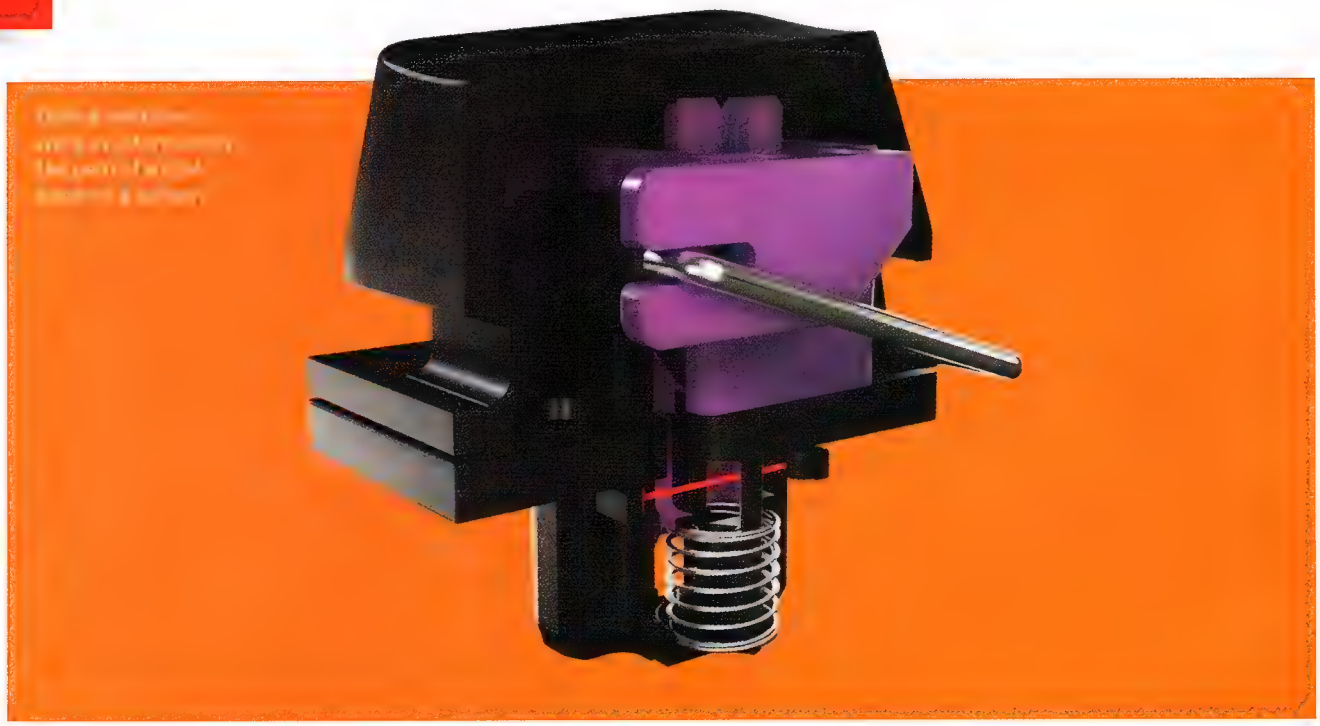
If you buy a top-spec cable to connect your gear, you expect it to glow, right? The Arquus W73 is indeed top spec – all snake-like 2.7M of it. The HDMI 2.0B-spec allows bandwidths of up to 18Gbps and that allows 4k at 60Hz, or deliver multiple streams to a single screen. It overcomes typical HDMI length restrictions by using fiber optics instead of copper cable, so there's far less signal loss over distance. A longer 4.5M version is also available. But the main selling point is surely that they can glow in seven different colours and have built in presets for strobing and the usual RGB dazzling. It even has a little micro USB cable near one end to plug in for extra power to make the lights even brighter.

$219, Ikea.com

Ikea smart blinds

SHEER AND BLACKOUT BLINDS THAT'LL REALLY LISTEN TO YOU.

Ikea already has a decent collection of smart lights and speakers, but the Sweedish flatpack furniture company is adding electric blinds to its smart home offering. The company is launching two versions of the blinds, one with a sheer curtain that dampens light called Kadrilj or a full blackout blind called Fyrtur. Both are able to be controlled by voice commands through wherever smart home system you currently use or using the Ikea Home app for your smartphone. While, on its own, blinds might not seem like something in dire need of automation, the ability to open the blinds in time with your alarm is a neat way to wake up naturally.



HEAD TO HEAD

Membrane vs. Mechanical vs. Optical Keyboards

We compare the three main keyboard switch mechanisms.

Which type of keyboard is best? Mechanical keyboards have been around for longer, but were supplanted by keyboards with softer, quieter membrane keys. Some gamers swear by the clickety-clack of mechanical setups, while others favor the new kid on the block, optical keyboards, which use light rather than physical metal contact filaments. We're going to try to put this issue to bed, but we fear that even the *APC* team might remain divided.

Value

Straight out of the gate, optical keyboards stumble. Using a combo of sturdy mechanical keys and lightbeam-based switches results in a costly manufacturing process, and optical keyboards tend to be expensive.

Membrane keyboards are almost unilaterally the cheapest option. Many business environments have made the shift to membrane keyboards, usually due to price and quietness. Generally, a multipurpose membrane keyboard is cheaper than a mechanical model with the same features, primarily due to the lower cost of the materials. Membrane key tech has effectively reached its apex, too, so industry efforts can be focused on making the production process more affordable.

Mechanical models sit somewhere in the middle. While the base technology behind mechanical key switches has been around for years, modern mechanical keyboards use delicate, expensive components in their key switches, and the tech is still being refined and improved. That's not to say that mechanical keyboards can't be affordable, but budget-friendly ones tend to be lower quality or feature-light compared to membrane keyboards of the same price. A clear winner, then.

Winner: Membrane

"Mechanical keys vary significantly when it comes to input response, with more expensive keyboards typically having less delay, but optical key switches register input at the speed of light, making optical keyboards the most precise"

Precision

Anyone who tries to convince you that membrane keyboards offer the best sensitivity and performance is wrong. Just *wrong*. Membrane keys do have advantages, but the precision of a mechanical key switch is simply superior. Cheaper membrane decks tend to have issues with key rollover, where rapid key presses fail to register separately, and many people find membrane keys feel spongy.

Some mechanical keyboards offer adjustable key actuation – the point to which a key must be depressed to register any input – and certain high-end units may even have keys with analog switches capable of registering variable inputs. Customisation is often king when it comes to mechanical keyboards, with gimmicks such as swappable key switches (commonly Cherry's color-coded MX switches).

Mechanical and optical keyboards are great for registering rapid simultaneous inputs – ideal for gamers and speedy typists. Mechanical keys vary significantly when it comes to input response, with more expensive keyboards typically having less delay, but optical key

switches register input at the speed of light, making optical keyboards the most precise of all.

Winner: Optical

Feedback

Physical typing feedback can be crucial when deciding what keyboard to buy. If you don't like how using it feels, you're not going to want to type on it every day. This is tricky for us to judge; this very writer prefers a flat, quiet membrane keyboard for office work, but craves chunky mechanical keys for gaming. Personal preference is a major factor.

Mechanical keyboards can have a variety of key press responses, from smooth Cherry MX Red switches to the more tactile MX Greens, which have an audible click and require more force to press. Optical keyboards use fixed LEDs and light sensors, so the actuation point usually can't be adjusted and key press sensation is more in control of the manufacturer.

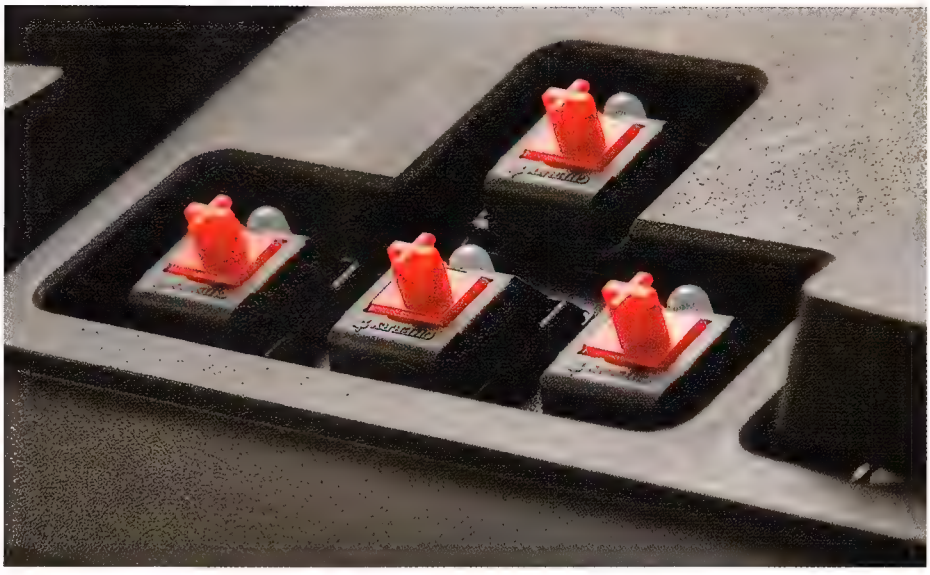
Membrane keyboards, on the other hand, tend to have less key travel and a more squishy typing sensation, as the base of each key presses against the flexible membrane below to close an electrical circuit. The membrane isn't as solid as the springs in mechanical and optical keyboards, but some users prefer that; for us, though, a sturdy mechanical key is more satisfying. You know when you've accidentally hit a key on a mechanical keyboard, which is why they get the win.

Winner: Mechanical

Ease of use

Membrane keyboards are quiet. Without a physical switch beneath the key, much of the noise produced by the keyboard is reduced or absorbed by the membrane underneath the keycap. Mechanical and optical models can be clattering monstrosities under the fingers of a fast typer. A physical switch produces more noise, and while optical keyboards can be slightly quieter than their mechanical brethren, both are beaten in the sound stakes by the mighty membrane.

Membrane keyboards tend also to be lighter and smaller than the others; their composition uses fewer metal components, and membrane keys can sit flush with the rest of the board due to their reduced travel. Only a select few could bear using a mechanical keyboard on their lap, while membrane ones can be incredibly light and thin.



Many mechanical switches have colored stems to indicate their resistance and sensitivity.

Membrane keyboards can be thinner and lighter due to the reduced travel of the keys.

Mechanical keyboards (and most optical ones) are easier to clean, as each key can be removed without the need for any tools. Blast compressed air into the space below and boom, clean keyboard. The keycaps can usually be washed separately, too. Membrane keyboard users don't enjoy this luxury, but they're still easier and quieter to use, so they win this round.

Winner: Membrane

Durability

This is where membrane keyboards really fall down. Where a mechanical or optical key will, in most cases, retain the same pressing sensation for its lifespan, the squishy layer beneath the keys of a membrane model wears away, changing the feel of the keys.

Mechanical keys last longer and the switches are also relatively straightforward to replace. Membrane keyboards are significantly harder to repair should a key fail, but will likely need replacing long before that point, due to the membrane wearing thin.

In terms of day-to-day use, optical keyboards have the longest lifespan. The key switches last longer than mechanical keys, due to the lack of delicate electrical contacts, and the key switches are usually simple to replace. So, why do mechanical keyboards win? While mechanical key switches might wear out a bit faster than optical ones, mechanical keyboards are more robust on the whole. Tiny light sensors and emitters mean that optical keyboards are more susceptible to damage, dust, and electrical failure. Mechanical keyboards last for ages, and if you drop one, the most you'll likely have to do is pop a few keycaps back on.

Winner: Mechanical

And the winner is...

It's a tie! Well, a tie between mechanical and membrane keyboards. The fact is that optical keyboards are a lot more niche, pricier, and don't really perform noticeably better than their high-end mechanical counterparts. Both mechanical and membrane keyboards have their advantages and disadvantages; you must consider the purpose you actually need a keyboard for.

If you're working in a crowded office, a noisy mechanical keyboard is a great way to annoy coworkers, but its improved precision makes it ideal for gaming at home. It's hard to say which type of keyboard is objectively better, because they both have their shortcomings. Some people prefer squidgy membrane keys, and some like the firm, responsive click of a mechanical switch.

We'd give the edge here to mechanical keyboards, but that does come down to personal preference. The significantly better lifespan of mechanical and optical keyboards makes them, at least in our eyes, worth the higher asking price. Ultimately, though, the best type of keyboard is the one you like using. ■

SPECIAL OFFER

Subscribe & get *APC* from only $5.79 an issue!

Take advantage of our trial subscription offer of six issues for $49 if you choose to auto-renew*

40th ANNIVERSARY ISSUE
SPECIAL COLLECTOR'S EDITION
1980: WHEN IT ALL BEGAN
apc
JUNE 2020 #481
The Compucolor II
APC'S FIRST REVIEW
Apple Macbook Air
SLEEK AND POWERFUL
The critical first 30 minutes
HOW FAR WE'VE COME
THEN & NOW
APC CELEBRATES 40 YEARS OF TECH & INNOVATION
LOOKING BACK SPECIAL FEATURE
What we said in issue 1
FORMER STAFF DISCUSS THE EARLY DAYS
PC HITS AND MISSES OVER THE YEARS
NVIDIA DLSS
how machine learning is changing gaming
KEYBOARD TYPES COMPARED
Membrane vs mechanical vs. optical
Asus ROG Zephyrus G14
Leading AMD's mobile revival

Save up to $99.80

Hurry! Offer ends May 17th 2020!

Two easy ways to subscribe to *APC* Magazine

VISIT **www.techmags.com.au** or CALL **(02) 8227 6486**

Get 12 issues of Australia's favourite tech mag for only $79!	Save even more and get 24 issues for $139 – that's just $5.79 per issue!	Free delivery of every issue straight to your door	Free full-version software downloads with every issue

TERMS & CONDITIONS: This offer expires June 14th 2020, and is available to subscribers within Australia only. Please allow 6-8 weeks for delivery of your first issue. For full terms and conditions, see: http://techmags.com.au/style/images/FutureTC.pdf Please see our privacy policy on page 3. *Six issues for $49, then $49 charged to your credit or debit card every six issues thereafter on auto-renewal.

40 years of talking tech

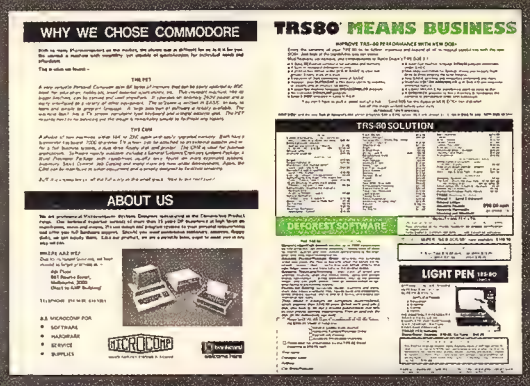
In May 1980 *Australian Personal Computer* was launched, just as the early PC was taking its first shape. Former writers and editors recall the tech and the times, the hits and the misses and what it was like working on *APC* during their tenures.

APC is a magazine about machines and technology, but it is made by people. For four long decades our writers, editors, designers, production people and the ad team have lived through the most impactful technology-driven change in society the world has seen. And it continues today.

Over the following pages many of the old team members have shared their thoughts and experiences about seeing technology change, and writing about it for you. These unique perspectives offer a rich insight into the tech of the time, and we asked each of them to nominate products or technologies that took off just as they predicted, plus the failures that never took hold, despite their expectations.

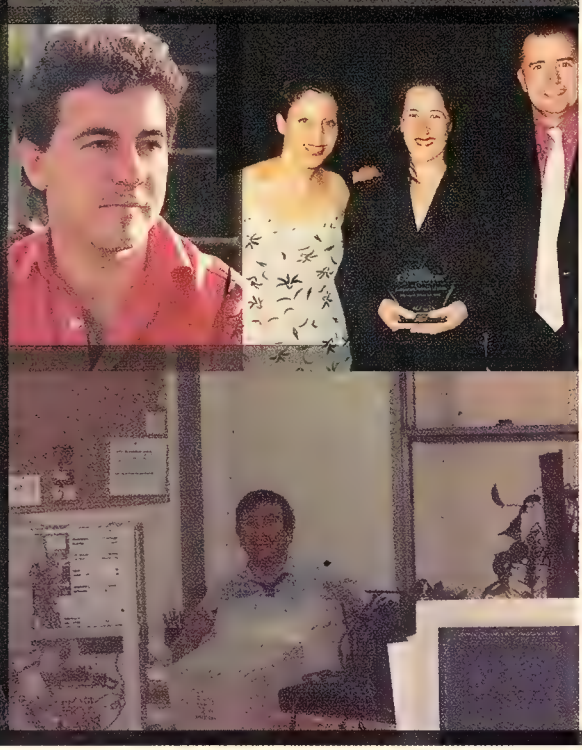
APC went through many transitions, too, in the ultra-competitive Australian magazine market, launching several spin-offs as well as taking the plunge into publishing digital editions. All the way through, the various *APC* teams worked hard to deliver you the very best in tech journalism, with deep technical analysis, yet focussing on what is relevant to you as the main mission.

We've made it this far, and many of you will have been with us for much of it. Whether you are new to *APC*, or have been enjoying it for years, we all thank you for being part of this continuing magnificent journey.



Sean Howard today, and (right in red shirt) back when *APC* was launched.

BOTTOM RIGHT: Jeremy White was the editor from 1994 - 1998 and was pivotal in shaping *APC*'s Australian content.



Sean Howard
The first editor

What was the inspiration for starting APC, and did you ever think it would become as successful as it has?

My 'inspiration' for producing *Australian Personal Computer* magazine comprised two elements: I was fascinated by the first true home (or 'personal') microcomputer: the Sinclair ZX80. It was launched in late January of 1980 but spoken and written about much earlier. To say that the ZX80 was innovative is to understate the adjective 'innovative' to such an extent that it leaves that adjective meaningless.

Oddly, I never bought a Sinclair. I spent my secondary school years in a brick shed with a tin roof in the backyard of our new house. Which I, incidentally, decorated completely in purple. It was the 70s after all. I mention this because the first issue of *APC* was typed by me in this shed. According to Google's sky photographs, it still stands.

I achieved a sufficiently good HSC result to enter the Melbourne University Medical School. As I studied medicine, I hated the course and spent my spare hours reading about personal computers. By coincidence, my father published several titles in his chosen field of chemical engineering. It occurred to me that I might bring to Australia a magazine about personal computers using my father's publishing experience as a resource. But where were the actual words for such a magazine to be found?

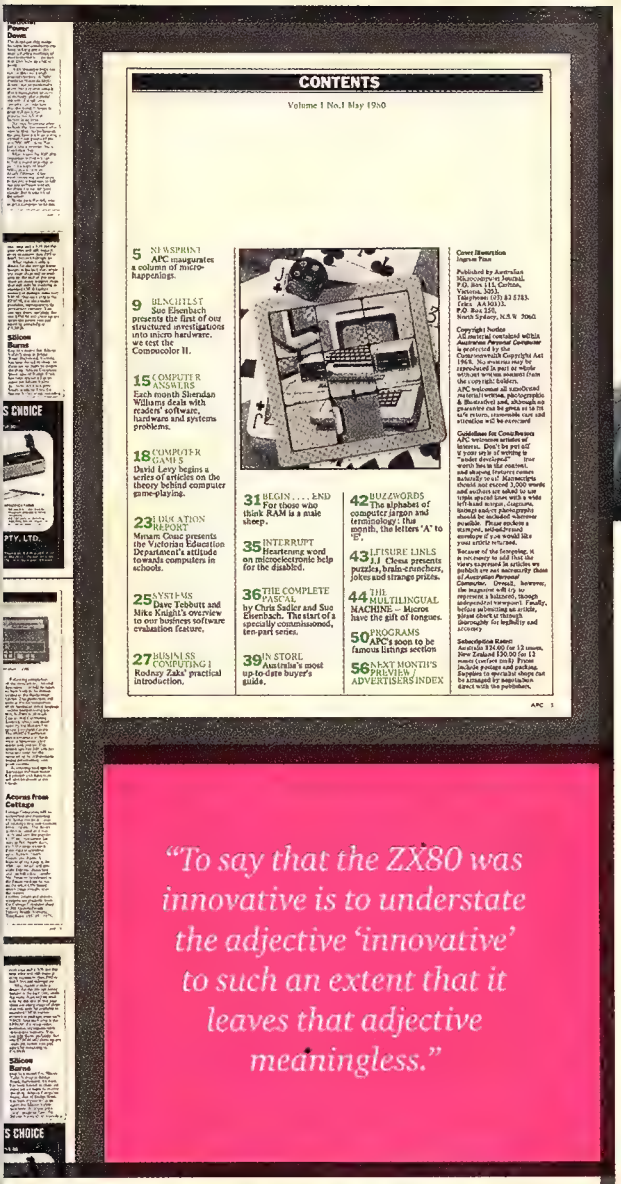
In 1978, at the age of 19, I had taken a three-month trip to Europe during one of our summer breaks and was astounded by the number of personal computer-related magazines and newspapers on the shelves of newsagencies and book shops. I bought one of each and lugged them back to Australia. There I wrote to every publisher of each of those magazines and newspapers.

In my letter I was seeking a licensing arrangement where the publisher would send me an advance photocopy of every issue about to go to press.

HIT

The Sinclair ZX80 was the first real 'personal' computer according to founding editor Sean Howard.

Of all the letters I wrote, I received just one reply. It was from a chap – one Felix Dennis – who turned out to be possibly the world's most eccentric person. He had been involved in launching the globally famous newspaper by the name of *Oz*. But Felix didn't send me a draft licence as one would expect from a prospective licensor. Instead, Felix sent me a huge box of every issue of every title which he had ever published in his stable of publications. He did include a letter – and this is the behaviour of the eccentricity of the man – that read to the effect that (i) start publishing; there is so much material in all these magazines, I hereby give you the right to reproduce and (ii) don't worry about a written deal – we can sort that out at a later date, and, finally, (iii) get going now before one of the larger publishing houses beats you to have the first and the best personal computer magazine in Australia.


CONTENTS

Volume 1 No.1 May 1980

5 NEWSPRINT
APC inaugurates a column of micro-happenings.

9 BENCHTEST
Sue Eisenbach presents the first of our structured investigations into micro hardware, we test the Commodore II.

15 COMPUTER ANSWERS
Each month Sheridan Williams deals with readers' software, hardware and systems problems.

18 COMPUTER GAMES
David Levy begins a series of articles on the theory behind computer game-playing.

23 EDUCATION REPORT
Miriam Cosic presents the Victorian Education Department's attitude towards computers in schools.

25 SYSTEMS
Dave Tebbutt and Mike Knight's overview to our business software evaluation feature.

27 BUSINESS COMPUTING I
Rodney Zaks' practical introduction.

31 BEGIN . . . . END
For those who think RAM is a male sheep.

35 INTERRUPT
Heartening word on microelectronic help for the disabled.

36 THE COMPLETE PASCAL
by Chris Sedler and Sue Eisenbach. The start of a specially commissioned, ten-part series.

39 IN STORE
Australia's most up-to-date buyer's guide.

42 BUZZWORDS
The alphabet of computer jargon and terminology. This month, the letters 'A' to 'E'.

43 LEISURE LINES
J.J. Clessa presents puzzles, brain-crunchers, jokes and strange prizes.

44 THE MULTILINGUAL MACHINE – Micros have the gift of tongues.

50 PROGRAMS
APC's soon to be famous listings section

56 NEXT MONTH'S PREVIEW / ADVERTISERS INDEX

Cover Illustration
Ingram Pinn

Published by Australian Microcomputer Journal, P.O. Box 141, Carlton, Victoria, 3053. Telephone: (03) 82 2783. (Telex AA30333, P.O. Box 226, North Sydney, N.S.W. 2060.

Copyright Notice
All material contained within Australian Personal Computer is protected by Australian Copyright Act 1968. No portion may be reproduced in part or whole without written consent from the copyright holders.
APC welcomes all unsolicited material (written, photographic & illustrative) and, although no guarantee can be given as to its safe return, reasonable care and attention will be exercised.

Guidelines for Contributors
APC welcomes articles of interest. Don't be put off if your style of writing is "under developed". Your words are the control, and shaping features comes naturally to us! Manuscripts should not exceed 3,000 words and authors are asked to use triple spaced lines with a wide left-hand margin. Captions, listings and/or photographs should be included where appropriate. Please enclose a stamped, self-addressed envelope if you would like your article returned.
Because of the foregoing, it is necessary to add that the views expressed in articles we publish are not necessarily those of Australian Personal Computer. Overall, however, the magazine will try to represent a balanced, though independent viewpoint. Finally, before submitting an article, please check it through thoroughly for legibility and accuracy.

Subscription Rates:
Australia $24.00 for 12 issues, New Zealand $30.00 for 12 issues (surface mail). Prices include postage and packing. Enquiries to specialist shops can be arranged by negotiation direct with the publishers.

APC 1

"To say that the ZX80 was innovative is to understate the adjective 'innovative' to such an extent that it leaves that adjective meaningless."

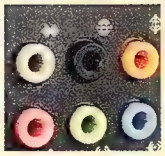
I was immediately drawn to Felix. It's true that we had long and expensive arguments on the phone. They always finished in us agreeing that the other was an arsehole and completely wrong. The next day – in each case – all was sweetness and a willingness to continue working together happily.

What does APC mean to you personally now? And are you involved in technology publishing in some form today?
Even though I no longer own it, I still regard it as a world-class magazine; and if offered the chance, would buy it back were its current owner prepared to sell it.

What's your fondest memory of building and growing APC into the title it became?
I think it may have our dinners. In Paddington, Sydney, there was a five-star restaurant located not too far from our offices. I despatched a memo to all staff with the message that any staff still at work at 9pm was entitled to pack up and grab a taxi to the restaurant for a complimentary dinner. That memory, or how I met my future wife in the *APC* offices.

Darren Yates

HIT
The USB drive saved us all from a mish-mash of competing proprietary storage formats.



MISS
Despite enormous potential, PC audio has failed to reach the levels of hi-fi quality it could have.

When did you work on APC and what was your role?
I officially started on *APC* in 2012. I've reviewed my fair share of PC gear (CPUs, PSUs etc), but my main role has been explaining different technologies and how you use them.

What does APC mean to you personally?
In a word, probably 'history'. As the world's longest-running PC technology magazine, *APC* has been something of a 'journal of record' for the PC era in Australia. It saw the arrival of the IBM 5150, it covered the launch of Windows 95, the CPU clock speed wars of the early-2000s and the rise of the Raspberry Pi.

Your fondest memory of working on APC?
The September 2012 issue. I wrote the cover feature on the rise of $50 single-board computers, which not only included the new tiny Android computer-sticks arriving from China, but also this odd little board called the 'Raspberry Pi'. However, publishing deadlines aren't forgiving and at the time, the Raspberry Pi was only a few weeks old – everyone wanted one and few were available anywhere in Australia.

So, after much chasing, the day a Raspberry Pi board finally made it into *APC* Labs – and coming in before deadline – was a pretty sweet one.

What is APC's role today, and into the future?
APC might be primarily about 'personal computers', but in a way, I think it also champions the broader concepts of science, technology, engineering and mathematics. Without maths, the other three don't exist and without the four of them, our modern world doesn't exist.

Name a PC tech or product that failed to take off despite your hopes and expectations, and one you called early and went big.
The 'big' one is easy – USB flash drives. Portable storage 20 years ago was a mess of floppy disks, Zip drives, portable CD burners, cables, power supplies and driver discs. So, when the original IBM-badged M-Systems Disk-on-Key arrived, this tiny USB stick with a whopping 8MB (yep, that's megabytes) of storage, you just knew it'd be a game-changer. We take it for granted today, but plugging in this tiny device and seeing a new drive letter in File Explorer was revolutionary. I still have that stick, too. As for 'tech that tanked', PC audio never reached the heights I'd hoped for. USB audio usually offered better signal-to-noise ratio (SNR) and total harmonic distortion (THD) but these concepts now seem to belong to another era.

What PC product or tech are you most excited about today?
It's not strictly 'PC', but it's executed on PCs. There's a lot of hype surrounding 'machine-learning' and almost as many naysayers, but like most things, the truth is somewhere near the middle – it probably scares and excites in equal measure. It's helping solve massive problems from climate change to COVID-19, create more efficient agriculture methods and save the Great Barrier Reef. Yet it also knows what I buy, when I buy, how much I spend and where I spend it – often before I do. Collectively, data can tell us new things about humanity, but individually, it can also be used to identify, manipulate and discriminate. The 'good' still well outweighs the 'bad' for now, but it's time we stopped giving away our data without thought.

Roulla Yiacoumi

When did you work on APC and what was your role?
From November 1995 to February 2001. I began writing hardware and software reviews, then moved onto news and features. I could not tell you how many stories I wrote about the 'Year 2000 Bug' – people thought planes were going to fall out of the sky when the clock ticked over from 1999 to 2000. I went on to be the editor of *Newswire*, Australian Consolidated Press' (*APC*'s then-publisher) first foray into online daily news.

What does APC mean to you personally?
APC was the start of my professional journalism career. We had an incredible editor in Jeremy White who encouraged us to write only for our readers – never for advertisers or sponsors. He gave us free reign to speak truthfully about anything we wrote. I will always be grateful for that gift.

Your fondest memory of working on APC?
The people, the camaraderie, the laughs. The varied and interesting work. The international travel. Working together in the labs until midnight to finish a big feature. The pain of packing up computers and gear to return to vendors. The even bigger pain of completing spec table spreadsheets for big features. The lifelong friendships. It was an amazing time to be a young journalist.

What is APC's role today, and into the future?
The role of *APC* is what it always was: to deliver uniquely Australian content to Australian readers. *APC* has been trusted for 40 years for a reason – readers appreciate the local perspective of knowledgeable experts, delivered in a style they relate to. I'm always pleased to see the current team continue that tradition. May *APC* live long!

HIT
It took Apple to get the PDA format right – and in a phone, too!

MISS
Despite early promise the Palm Pilot stumbled with getting usability perfected.

Name a PC tech or product that failed to take off despite your hopes and expectations, and one you called early and went big.
I was using a smartphone, or PDAs as they were known back then, very early in the piece (hello, xda and Palm Pilot!) and could see the enormous value in having your phone, contacts and internet all in one portable device. But too many devices had shortcomings, including some that wiped all of your data when the battery went flat! I absolutely knew a consumer smartphone was something that would take off for the vendor that got it right. That vendor turned out to be Apple and the iPhone slaughtered the market. Nokia and Blackberry became but distant memories.

One thing I had hoped would take off but never did was walkie-talkie functionality on mobile phones. For a while, there were phones with a button on the side that you simply pressed and spoke. I thought that was fun! But the telcos couldn't work out how to charge for it, and soon after, SMS made the need to send quick messages ultra-convenient.

What PC product or tech are you most excited about today?
I could say something cool, like AI or robotics, but honestly, the tech that most excites me today is tech that actually delivers what it promises, works without dramas, and doesn't cost an arm and a leg. That's not too much to ask, is it?

APC memories

ROULLA EXPLAINS HOW SHE LEARNED TO BE A GEEK AND GOT GOOD AT IT.

I began working at *APC* a week after I graduated from uni at the end of 1995. I didn't know a thing about computers but I must have done well at the two writing tasks they set at the interview because they offered me a job! I was hired in a cohort that included massive tech geeks Ashton Mills and Nathan Taylor. I felt like the biggest dummy next to them. I was the only one who owned a Mac, which the two of them teased me about mercilessly.

The first six months were a massive learning curve. I don't think I slept the entire time – I was stressed to the max. I was mildly geeky in that I hung around bulletin board systems (BBSes) a fair bit but that was the extent of my tech knowledge.

I remember the first time I had to remove a cover from a computer and examine the insides to count RAM slots and hard drive expansion bays. I had no clue how to do that! I called my geek boyfriend and got him to talk me through it, while whispering questions into the phone so none of my co-workers could hear how clueless I was.

It was a crazy time to be in tech publishing in Australia. Our editor, Jeremy White, had decided to ditch the content licences for the overseas publications we were using and bring Australian writers onboard to produce local content. It was unheard of at the time.

I started at *APC* writing hardware and software reviews and later moved onto news and features working under Helen Dancer. I also introduced a monthly consumer column to the magazine on the back of a disaster. We once gave a local computer business an Editor's Choice award and they just ripped people off by not supplying the goods. The complaints we got from readers were off the charts and I ended up getting a death threat from the business owner for exposing his shonky practices.

Back in 1995, we had one computer in the corner of the office which was the "internet computer". If you wanted to use the internet, you had to book the computer! Sounds hilarious now, but we're talking about 25 years ago! That was when AOL was sticking free discs on the cover of every magazine to get some traction into the Australian market.

I look back on my time at *APC* as the best time of my professional life as a journalist. Ashton and Nathan are still two of my best buddies, along with Angus Kidman, who joined the team after we started.

Dan Gardiner

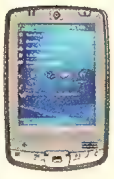
When did you work on APC and what was your role?
I've had a few different roles at *APC* – a hardware and software reviewer, deputy editor and, finally, editor of the mag itself for five years, from 2013 to 2018.

What does APC mean to you personally?
I have a special fondness for *APC*, and not just because I was editor: *APC* actually gave me my first full-time job out of uni, and as a lifelong PC enthusiast, that was pretty much a dream come true. Technically, I was hired for the role of feature writer, but it quickly became evident to then-editor Nathan Taylor that PC hardware was my real forte, so I largely ended up working as a reviewer. That meant spending many a blissful day toiling away in the *APC* Labs, neck deep in benchmarks while testing the latest PC gear... gear that I'd also happily spend most of my leisure time (and disposable income) playing around with.

Your fondest memory of working on APC?
It's a bit of a cop out, but I loved every minute of my time on the mag. Honestly, no tech writer could have asked for a better start in the industry – my first year of working for *APC* introduced me to a crew of journalists who I'd quickly come to hold in the highest regard (and many of whom have since become life-long friends). Their high expectations for the mag, and of the team creating it, are something I've carried with me all these years, and tried to stamp onto any other mag or website I've worked on. When I came to edit *APC* in 2013, it was with a great sense of pride in its history, quality – and a desire to live up to the standards of the all great editors who'd come before me.

What is APC's role today, and into the future?
The fact that it's still standing some 40 years later – making it the longest-running English language PC mag in the world – is a great testimony to its ability to adapt to the times and stay relevant. The web is undoubtedly great for some forms of tech coverage, but there's still something special about the 'package' that a magazine presents, and *APC*'s amazingly loyal readership (some of our subscribers have been reading the mag since its inception) demonstrate that it's a formula that many Aussies still value.

HIT
A good laptop is central to getting things done, and performance and designs are always improving.



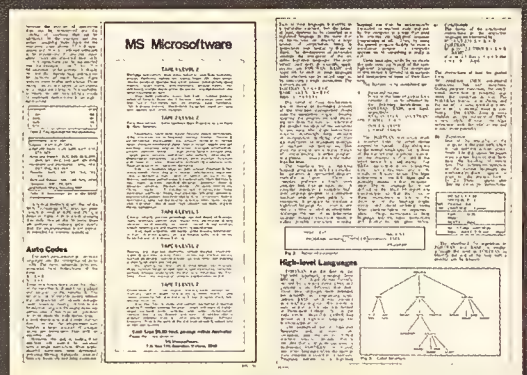
MISS
As much as Dan wanted Windows Mobile to be perfect, it sadly never was and doomed all the otherwise fine devices it ran on.

Name a PC tech or product that failed to take off despite your hopes and expectations, and one you called early and went big.
The PDA. I has a die-hard fan of Compaq (and then HP's) iPAQ devices in the very early 2000s, which ran Windows Mobile and were marketed as Pocket PCs. The touch controls sucked, but with a full-colour display, a desktop full of icons and Internet Explorer onboard, they did genuinely feel something like having a computer in your hand. They're perhaps Microsoft's biggest missed opportunity – all the ingredients were there to create a killer smartphone (and they did add phone capabilities eventually), but Microsoft's engineers didn't have the foresight (or perhaps willingness) to radically rework and optimise Windows for touch, leaving the door wide open for Apple to create the iPhone... and make PCs truly portable.

What PC product or tech are you most excited about today?
The laptop. I've tested and reviewed hundreds of them over the last 20 years and despite the rise of smartphones and tablets, the laptop is still the workhorse computing device that I turn to when I need to get something done. I still love my grunty desktop rig for specific tasks like gaming, but for day-to-day use the laptop is the perfect PC. They may not change as much year-on-year as they used to, but getting hands-on with an anticipated new model (even if it's just the latest revision of Dell's trusty XPS 13) is still a thrill.

BELOW: *APC*'s first games section went deep into analysing the heuristics and algorithms behind a simple puzzle game. We don't do that anymore.

The 1990s *APC* office was a busy place, also a dark one, with big CRTs apparently providing the only illumination.



"Why would Microsoft release something so badly thought out? I'm intrigued to see that Microsoft still has issues with Windows, this time with updates. WTF?"

Tony Sarno

When did you work on APC and what was your role?
Editor from 2004 to 2013. When I got there my main role was to figure out a way forward amid declining magazine circulations, which for the *ACP* stable pretty much started in 1998 as users started finding their information online. For *APC*, that was the period after the heyday of the Jeremy White years and 80k-90K circulations. My main contribution was to help redefine *APC*'s personality for long term survival, which was to reduce the articles for developers & IT managers and take it to a middle ground of power users and intelligent tinkerers, but still keeping it well away from the mass market that *PC User* served so well.

What does APC mean to you personally?
I'm trying not to be biased here, but I think in its heyday *APC* was the single most important publication in Australia. It informed the very people that would transform tech in this country, at home and at work. It was one of the engines of the tech boom. I feel privileged to have edited it and worked for Kerry Packer, the giant of Australian media history. Not that Kerry knew me or anything but I did bump into him in a lift at Park Street once.

Your fondest memory of working on APC?
Becoming the first major newsstand magazine to appear on iPad in Apple's Newsstand in Australia. When Steve Jobs unveiled the iPad I was convinced he'd announced the future of magazines. I pushed and harangued *ACP* to give me the money to create an iPad edition. We got there in the end (after a trip to Malaysia to learn an Adobe iPad CMS), and when we downloaded the first issue onto our iPads, it was a truly memorable moment. My other fond memory is of all the free tech gear that came my way as editor!

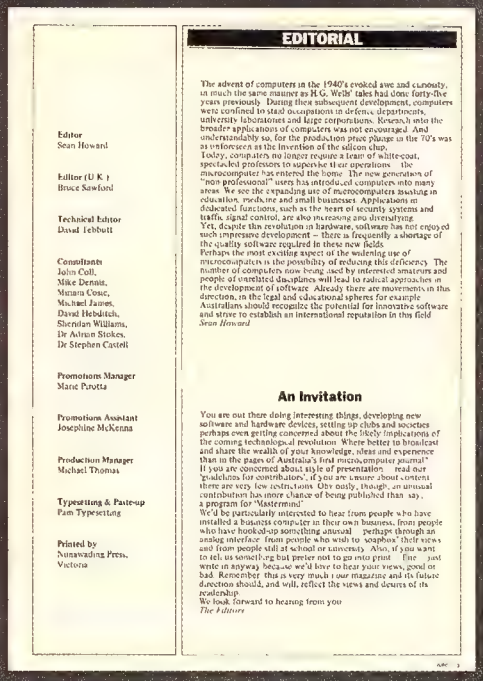
HIT
Siri, along with her AI friends Alexa and Google Assistant, are taking over our lives, and we welcome it.

MISS
APC was one of the few in the media to call out how truly awful Windows 8 really was.

My least fond memory was having to round up freeby software and plastic trinkets for our monthly tipons. Those tipons were the bane of my life at *APC* but they spiked circs when we managed to get something valuable on there.

What is APC's role today, and into the future?
The fundamentals of the mag today appear to pretty similar to when I had it. *APC* should keep me abreast of the cool new tech and skills that I can use to create things with. There will always be a need for a magazine that does that.

Name a PC tech or product that failed to take off despite your hopes and expectations, and one you called early and went big.
I'm embarrassed that I thought Chromebooks would be big. Little more than dumb terminals, I was convinced they would become the people's computer. No-one bought them. We even did a Chromebooks special. Groan. Closer to home, with our iPad magazine in it,



EDITORIAL

The advent of computers in the 1940's evoked awe and curiosity, in much the same manner as H.G. Wells' tales had done forty-five years previously. During their subsequent development, computers were confined to staid occupations in defence departments, university laboratories and large corporations. Research into the broader applications of computers was not encouraged. And understandably so, for the production price plunge in the 70's was as unforseen as the invention of the silicon chip.
Today, computers no longer require a team of white-coat, spectacled professors to supervise their operations - the microcomputer has entered the home. The new generation of "non professional" users has introduced computers into many areas. We see the expanding use of microcomputers assisting in education, medicine and small businesses. Applications in dedicated functions, such as the heart of security systems and traffic signal control, are also increasing and diversifying.
Yet, despite this revolution in hardware, software has not enjoyed such impressive development – there is frequently a shortage of the quality software required in these new fields.
Perhaps the most exciting aspect of the widening use of microcomputers is the possibility of reducing this deficiency. The number of computers now being used by interested amateurs and people of unrelated disciplines will lead to radical approaches in the development of software. Already there are movements in this direction, in the legal and educational spheres for example. Australians should recognize the potential for innovative software and strive to establish an international reputation in this field.
Sean Howard

An Invitation

You are out there doing interesting things, developing new software and hardware devices, setting up clubs and societies perhaps even getting concerned about the likely implications of the coming technological revolution. Where better to broadcast and share the wealth of your knowledge, ideas and experience than in the pages of Australia's first microcomputer journal?
If you are concerned about style of presentation read our "guidelines for contributors", if you are unsure about content there are very few restrictions. Only easily, though, an unusual contribution has more chance of being published than say, a program for "Mastermind".
We'd be particularly interested to hear from people who have installed a business computer in their own business, from people who have hooked-up something unusual perhaps through an analog interface, from people who wish to 'soapbox' their views and from people still at school or university. Also, if you want to tell us something but prefer not to go into print fine just write in anyway, because we'd love to hear your views, good or bad. Remember this is very much your magazine and its future direction should, and will, reflect the views and desires of its readership.
We look forward to hearing from you
The Editors

Editor
Sean Howard

Editor (U.K.)
Bruce Sawford

Technical Editor
David Tebbutt

Consultants
John Coll,
Mike Dennis,
Miriam Close,
Michael James,
David Hebditch,
Sheridan Williams,
Dr Adrian Stokes,
Dr Stephen Castell

Promotions Manager
Marie Perotta

Promotions Assistant
Josephine McKenna

Production Manager
Michael Thomas

Typesetting & Paste-up
Pam Typesetting

Printed by
Nunawading Press,
Victoria

"Thinking back on it, I'm stunned at the sheer volume of content we produced. By 2000, we were putting out a monthly magazine with a double cover CD, a daily news site, a weekly CD title and a bunch of Pocketbook specials."

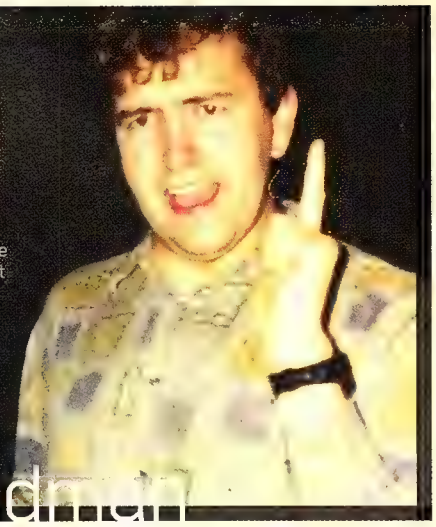
Apple Newsstand didn't set the world on fire, Apple never really understood what to do with Newsstand and eventually discontinued it.

One thing we caught early was how truly bad Windows 8 was. We were the first publication to be honest about the new operating system's inexplicable flaws. Win 8 was a usability shit show and very early the press was skirting around just how bad it was. I remember having long conversations with Darren Yates asking why would Microsoft release something so badly thought out? I'm intrigued to see that Microsoft still has issues with Windows, this time with u pdates. WTF?

What PC product or tech are you most excited about today?
Siri and what she (and Google Assistant, Alexa etc) stand for: the more intelligent interfacing of technology with our lives. When combined with artificial intelligence and what big tech knows about us already, they will take over our lives to a degree unfathomable now.

HIT
Machine learning is accelerating at an unbelievable rate and is transforming the world day by day.

MISS
Even the finest-ever mobile keyboard couldn't save the Blackberry.



Angus Kidman

When did you work on APC and what was your role?
I joined *APC* in 1996 after being poached by then-editor Jeremy White during a friendly game of pub snooker. Definitely the easiest job interview ever! I started off with the cumbersome title of senior writer (news). Over five years I progressed through to being news editor, editor for our *Newswire* site, editor-in-chief and web editorial director. When I joined *APC* had only just launched its online presence; those were the days of running exhaustive tests on 56Kbps modems and hand-coding web sites.

What does APC mean to you personally?
APC was the place where my journalism career really flowered. I was working with a fantastic and ever-expanding team of fellow tech freaks, being mentored by experts, and learning the ropes for all kinds of writing: reviews, news, opinion columns, how-to guides, even humour. Plus I got early access to all this amazing gear and travelled the world chatting to people about it. What more could you want?

Your fondest memory of working on APC?
The people were fabulous, and I'm friends with many of my colleagues from that era to this day. Thinking back on it, I'm stunned at the sheer volume of content we produced. By 2000, we were putting out a monthly magazine with a double cover CD, a daily news site, a weekly CD title and a bunch of Pocketbook specials. And printing tech wasn't particularly advanced, so we had to send the magazine off in batches across the whole month. There were a lot of late nights and a lot of pizza! I'm very proud of being there when we had an issue that sold 100,000 copies, a figure any magazine in Australia would kill for these days.

What is APC's role today, and into the future?
Technology seems all-pervasive these days. However, there's a big difference between someone who just uses their mobile phone for Facebook and someone who wants to know how it works, how well it performs, and how they can hack it. That's the *APC* reader. Our guiding principle at *APC* was always that we were writing for an audience who were passionate about technology. That audience will always need serving.

Name a PC tech or product that failed to take off despite your hopes and expectations, and one you called early and went big.
I'm slightly bitter that BlackBerry never successfully made the transition from running its own mobile phone operating system into the Android universe. I still think the BlackBerry keyboard remains the best input system for a mobile device, but we're stuck in a touchscreen world now. Ah well.

As for successful predictions: It seems like a futile boast in an entirely online world, but I was onto the internet bandwagon very early. Indeed, when I joined *APC*, I was the only person who actually had an internet connection at their desk!

What PC product or tech are you most excited about today?
Machine learning is just stupidly exciting. My degree was in linguistics, and in the mid-1990s it seemed inconceivable that we'd ever get technology to handle translation automatically. Machine learning is bringing that prospect ever closer. I get that some folks find the idea of machines that can think in ways their inventors don't really understand terrifying, but for me that's exhilarating.

Nathan Taylor

When did you work on APC and what was your role?
I worked at *APC* from November 1995 to February 2001, starting as a cadet under the amazing Jeremy White and working my way up through technical editor and then editor.

What does APC mean to you personally?
As a young computer nerd in the 80s and 90s, *APC* was essentially Australia's technology bible. It was the biggest and best computer magazine of the day, and it was utterly intimidating to go and apply, as a fresh journalism graduate, for a cadet role. To actually get that job was a dream come true: my first job as a journalist, and the one that set me on a career path I still enjoy today.

Your fondest memory of working on APC?
APC was one of those formative workplaces that so few people get to experience. I have lifelong friends from my time there, and glowing memories of the positivity and energy that infused the place – it felt very much like a startup, where everyone was genuinely committed to making the best possible product no matter what hours were required.

There's one memory that never fails to bring a smile to my face, however. In one issue we decided to insert a full pull-out poster of Linux shortcuts and commands, but we had nothing to put on the reverse side. So, at the suggestion of our Editor in Chief no less, we decided to blow up a picture of Bill Gates getting hit in the face by a cream pie by pranksters in Brussels in 1998. That took up the entire reverse side of the poster. I was a little doubtful of the propriety of doing so, but I went with it and the response still makes me laugh, from the readers writing in and thanking us for the helpful Linux tips that we put on the back of the Bill Gates poster, to the terse (multiple) phone calls I received from Microsoft PR representatives to protest the poster.

What is APC's role today, and into the future?
There's a thing that magazines do that the internet has really failed to replicate. The internet is great at telling you about the things you specifically asked for – but no more. Want to know what people thought of a particular product? Google it, and you'll probably find a laborious 15-page review detailing it down the screwholes. But magazines offer something that can't be easily replicated by the internet: a curated experience, telling you about things you didn't even know you were interested in before you read about them.

I tend to think of them like variety shows, offering bits of diverse information for a target audience it knows well. And *APC* has had 40 years to get to know its audience: what kinds of science and technology news they might like; what kinds of problems they have that need solving; the DIY projects they might find fun or cool; what products they like to hear about.

It still provides that kind of human-curated knowledge that no internet content algorithm has yet been able to replicate, and I fully expect it will continue to do so for years yet.

Name a PC tech or product that failed to take off despite your hopes and expectations, and one you called early and went big.
The graveyard of failed technologies that I was, in their time, a fan of, is rather vast. But perhaps the one that surprised me the most is Napster, a company that revolutionised file sharing on the internet and was once on the lips of every PC user on the planet. In retrospect it couldn't have gone any other way – the company was sued into oblivion by copyright holders and never got the chance the find a more legitimate use for its technology and network.

HIT
Portable MP3 music players were an instant success, but, once again, it took Apple to rectify the sins of early devices.

MISS
Napster introduced most of the computing world to the magic of file sharing, but its underlying dependence on piracy doomed it from the start.

There were some I got right. Portable MP3 players, which hit the big time with the Apple iPod, seemed destined for greatness even when the first products that came out (mostly from small Taiwanese manufacturers) were mostly very, very bad. Integrated 2D/3D graphics cards (GPUs), pioneered by a small company called Nvidia to take on the likes of Matrox, Voodoo Graphics and SGI were another one I called early. But perhaps my biggest early call was smartphones, being massively impressed with the ideas behind the 1996 Nokia Communicator, if not the particular execution. Clearly I called that one way too early – it wasn't until 2007's iPhone that everything really came together, but I'm still going to claim it!

What PC product or tech are you most excited about today?
The artificial intelligence renaissance of the past decade has me genuinely excited – and fearful – for the future. If the internet and smartphones have defined the last three decades of technology, I expect AI will define the next three – and beyond.

The growth in parallel computing power through GPUs and now dedicated AI processors has led to huge breakthroughs. Self-driving cars are just the start. Fundamentally there is no human task that will not be able to be performed by an AI.

That's an incredible idea – that humans can be freed from all labour and be set free to enjoy life, although most AI researchers put the timeline for that out to 50 years and more (and I'm in general of the view that AI uptake will be slower than many think, since inertia is a powerful force).

It's also terrifying. Not in the Elon Musk end-of-all-humanity *Terminator* scenario, but in the transition to that world. How does a capitalist society adjust to mass unemployment? How do resources get distributed without wages? Will there need to be some kind of revolution to forcefully redistribute ownership of capital? We'll have to wait and see.

A golden era of blossiming technology

NATHAN TAYLOR REMEMBERS THE TRIUMPHS AND STRUGGLES OF THE 1990S.

I began my time at *APC* in 1995, coming to start work at the most nightmarish time of year: the annual PC review. Once every year, the magazine would review 100 PCs – sometimes more – all fully benchmarked, thoroughly reviewed and meticulously detailed in massive specification tables. From lowly 386s to those fancy new superscalar Pentiums, we covered them all. As you might imagine, it was a logistical horror show.

Even in 1995, *APC* was 15 years old. And yet, there was still an incredible startup-like energy at the magazine. We all felt that we were reporting on the beginning of something incredibly important, something world-changing.

That thing, of course, was the blossoming internet. Hardware and software still dominated our coverage, but more and more it became about the internet. We recognised even then that web was the new platform, and that over time the hardware and software on which it ran would become less relevant.

We launched several websites, including an ahead-of-its time news service with a dedicated team of journalists. We also started the incredibly successful cover discs, which allowed people to enjoy the bounties of internet downloads without having to wait the sometimes days it would take to get many of these programs over a dial up modem (Linux distributions were particularly popular).

For my part, the best things to work on were the future technologies features, looking at the things that would define our world in the next five or ten or twenty years. Inspired by the likes of *Byte Magazine* and *Wired*, we ran lots of features covering advances in lithography, the explosive growth in the power of fibre, how hard drives and optical media would evolve, how web services would redefine company interactions and more. We interviewed pioneers in their fields, and got a glimpse of the things that would change the technology landscape years in advance.

There were certainly a lot of 'five years away' technologies that never panned out: nano machines, holographic storage, quantum computers, optical computing and many others. Some may yet still come unto their own when the time is right (just look at VR, for example), but the timelines of the optimistic boosters were way off.

And there have been technologies where the result have been... mixed. The internet, for all its incredible breadth and absolute ubiquity, has itself in many ways become less than what we hoped for. A far cry from an egalitarian platform of open sharing and global communications, it has instead helped people retreat into ideological bunkers where they never have to hear anything that might disrupt their worldview. It's a platform for information, but also for misinformation, for commerce and crime both.

Still, it's good to know that even now journalism survives, and I'm hopeful that media like *APC* can continue to stick around and help us divine fact from fiction.

intel
Pentium M
inside
Windows Home Server
HIT
It wasn't until the Pentium M that laptops had a chipset that was properly designed for mobility.
MISS
Home servers failed to take off – even with a dedicated OS – and the world had to wait for the NAS boom for the concept to be done right.

David Flynn

When did you work on APC and what was your role?
Editor, January 2001 to January 2004.

What does APC mean to you personally?
It's about unlocking technology, by which I mean not just explaining tech but really diving into it and letting you take it further.

One example: I remember discovering bulletin boards through reading *APC* in the late 1980s. Here was a magazine which not only covered the necessary hardware of modems but had a monthly BBS listing plus tips and techniques on using bulletin boards, offline readers – you could go from zero to, well, at least halfway to hero. No other magazine let you springboard like that.

What is APC's role today, and into the future?
Like all print publications, *APC* is super-challenged by the internet – it always has been, since ADSL broadband took off. In that context, I believe *APC*'s place in this hyper-connected world is that it continues to not only be relevant to readers but to connect with them, to be their magazine, one that's worth spending money on and spending a few hours with.

Your fondest memory of working on APC?
Covering the launch of Intel's original Pentium M notebooks – the first laptops with a truly 'made for mobile' processor plus inbuilt Wi-Fi – in March 2003. This was an extraordinary leap for users and for the industry, and a highly-anticipated launch. So in addition to the usual features and a dive into the Banian microarchitecture and the Centrino platform, we corralled a bunch of Australia's first Pentium M notebooks into the labs for review, brought forward our printing slot and on-sale date to be just ahead of all the competing magazines, and even took bundles of the first-run 'earlies' of our magazine to hand around at Intel's big launch event.

It was a team effort for everyone from the writers to production, and it meant we out-gunned all the other magazines in timeliness and depth of coverage.

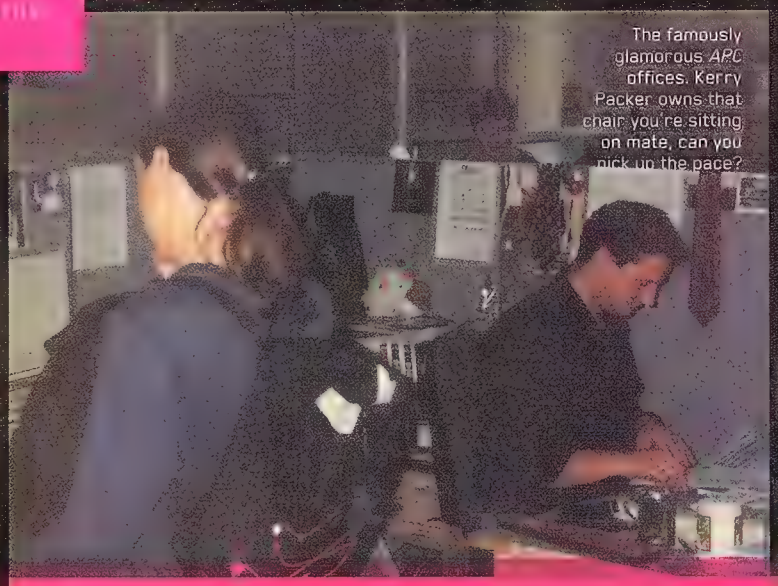
But this wasn't just about Being First: it was also a statement of intent for *APC* magazine, to underscore the title's leadership in the tech space.

Name a PC tech or product that failed to take off despite your hopes and expectations, and one you called early and went big.
Hit: We went big on broadband. Really big, from hiring broadband boffin Dan Warne as a writer to launching Australia's most comprehensive broadband ISP tests and ratings system.

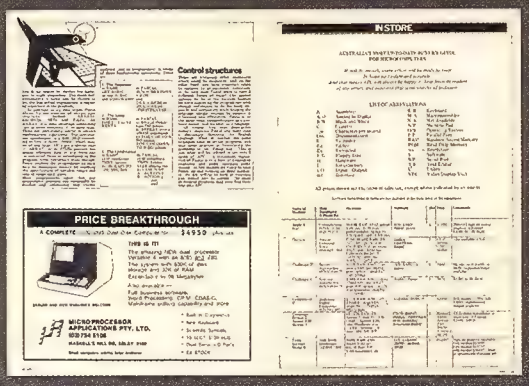
Miss: Home servers. We had broadband, we had BitTorrent, we had barebones small form-factor PCs like the Shuttle XPC, and we had Linux. I was always amazed these planets didn't align in a more pervasive way.

What PC product or tech are you most excited about today?
Intel's Athena project, Windows on ARM, Mac on ARM for that matter. Thin, light and powerful laptops with inbuilt 4G LTE modems as standard kit (not a cost-extra option) and 20 hours of usable battery life? For road warriors like me, it's heaven on a stick.

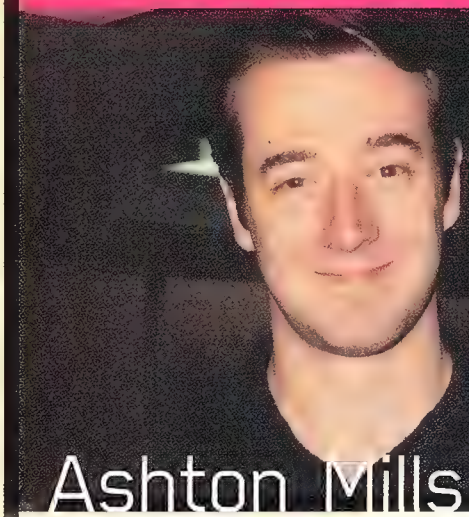
After leaving APC, Flynn went on to launch a mobile computing magazine and a website for business travellers and frequent flyers. He is now Editor-in-Chief of ExecutiveTraveller.com.



The famously glamorous *APC* offices. Kerry Packer owns that chair you're sitting on mate, can you pick up the pace?



"APC was always the go-to title for the latest and greatest tech information for Aussies, and that role hasn't changed"



RIGHT: Nathan, Selina Mitchell (technical journalist on *APC*), Roulla and Ashton.

BOTTOM RIGHT: Alex Kidman, another *APC* legend, does his best Albert Einstein impersonation.

Ashton Mills

When did you work on APC and what was your role?
1995-2000. I began my career as a journalist there, starting as a junior, then on to managing the Workshop section of the magazine (which was the tutorials and how-to section) and finally my own editorship with the Pocketbook series – a pioneering A5 mixed book/magazine format, which we made work with no ads!

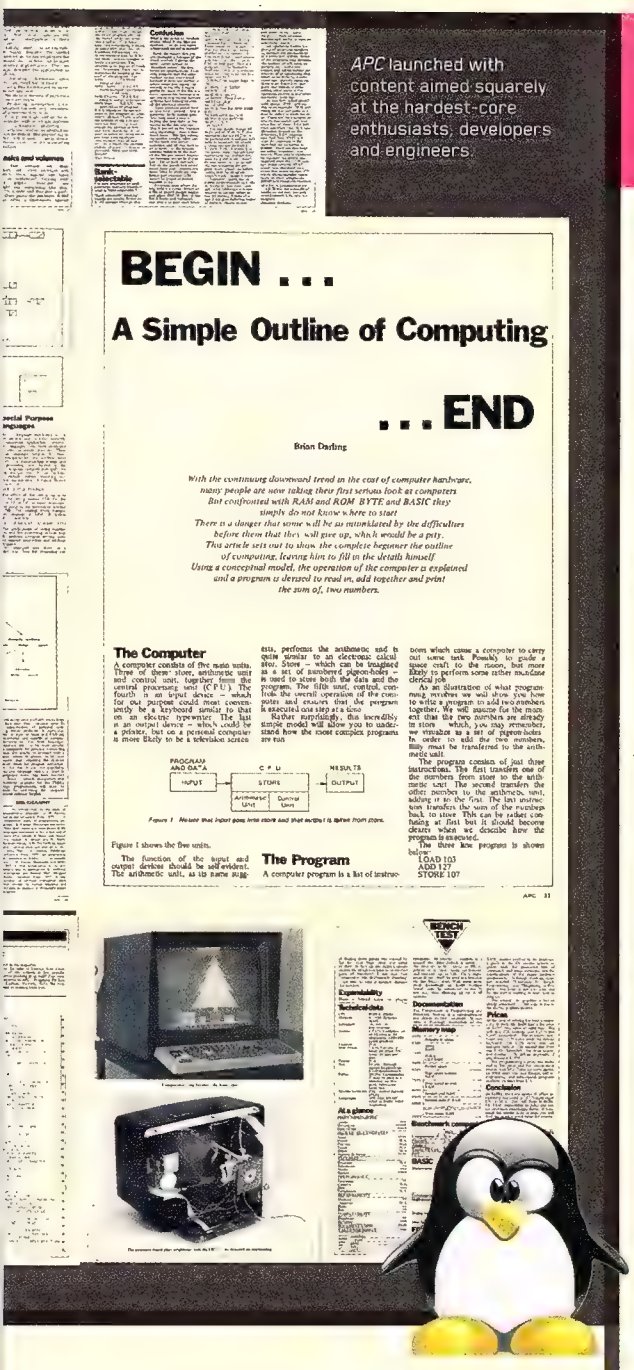
What does APC mean to you personally?
A lot! It gave me the start of my career, I learnt and honed my craft there, I got to work with some amazingly talented people, and I made friends and colleagues that I am still friends with (and occasionally work with) today.

Your fondest memory of working on APC?
Now that's hard :) It has to be working with some wonderful people, especially those who started at the same time I did – two especially as we were all employed as junior journos around the same time: Roulla Yiacoumi and Nathan Taylor. Along with other *APC*ers, we all worked so well together that it didn't often feel like work, we loved what we did and we loved doing it with the people we were with. It isn't always easy to find that in a workplace.

What is APC's role today, and into the future?
APC was always the go-to title for the latest and greatest tech information for Aussies, and that role hasn't changed, just the mediums of delivery!

After his time at *APC*, Ashton took on the editorship of enthusiast title *Atomic*, followed by several years at the Australian Computer Society.

Name a PC tech or product that failed to take off despite your hopes and expectations, and one you called early and went big.
I'm going to name one product that meets both categories. Especially coming from me, having written *The Linux Pocketbook*. Linux as a desktop operating system. I thought Linux on the desktop was inevitable, and by now it would be at least as popular as Windows. And of course it's not, it didn't go big in that way. But it did in another: it became the foundation for Android. Between being the backbone of the internet and running the world wide web, and driving the lion's share of mobile devices world-wide, Linux is big just about everywhere – everywhere except the desktop, that is.



APC launched with content aimed squarely at the hardest-core enthusiasts, developers and engineers.

BEGIN ...

A Simple Outline of Computing

... END

Brian Darling

With the continuing downward trend in the cost of computer hardware, many people are now taking their first serious look at computers But confronted with RAM and ROM BYTE and BASIC they simply do not know where to start There is a danger that some will be so intimidated by the difficulties before them that they will give up, which would be a pity. This article sets out to show the complete beginner the outline of computing, leaving him to fill in the details himself Using a conceptual model, the operation of the computer is explained and a program is devised to read in, add together and print the sum of, two numbers.

The Computer

A computer consists of five main units. Three of these store, arithmetic unit and control unit, together form the central processing unit (CPU). The fourth is an input device – which for our purpose could most conveniently be a keyboard similar to that on an electric typewriter. The last is an output device – which could be a printer, but on a personal computer is more likely to be a television screen

PROGRAM AND DATA → INPUT → C P U (STORE, Arithmetic Unit, Control Unit) → OUTPUT → RESULTS

Figure 1 Shows the five units.

The function of the input and output devices should be self-evident. The arithmetic unit, as its name suggests, performs the arithmetic and logic similar to an electronic calculator. Store – which can be imagined as a set of numbered pigeon-holes – is used to store both the data and the program. The fifth unit, control, controls the overall operation of the computer and ensures that the program is executed one step at a time

Rather surprisingly, this incredibly simple model will allow you to understand how the most complex programs are run

The Program

A computer program is a list of instructions which cause a computer to carry out some task. Possibly to guide a space craft to the moon, but more likely to perform some rather mundane clerical job

As an illustration of what programming involves we will show you how to write a program to add two numbers together. We will assume for the moment that the two numbers are already in store – which, you may remember, we visualise as a set of pigeon-holes. In order to add the two numbers, they must be transferred to the arithmetic unit.

The program consists of just three instructions. The first transfers one of the numbers from store to the arithmetic unit. The second transfers the other number to the arithmetic unit, adding it to the first. The last instruction transfers the sum of the numbers back to store. This can be rather confusing at first but it should become clearer when we describe how the program is executed.

The three line program is shown below:

LOAD 103
ADD 127
STORE 107

APC 31

BENCH TEST

Expandability
Technical data
Memory maps
Decoration
Prices
Conclusion
At a glance
Benchmark comparisons
BASIC

What PC product or tech are you most excited about today?

I have to pick two, because they are equally transcendental – VR/AR, and AI. It cannot be understated just how revolutionary these technologies are about to become to our society, the way we work and live, and ultimately to our species. AI especially is the next 'invention of the wheel'. Come another 40 years, it's going to be ingrained in everything we touch and use, and will forever be a part of us until the Sun explodes and the Earth becomes dust. Not to be dramatic, but there it is.

HIT

Linux proved to be a winner as the foundation for Android, which is everywhere.

MISS

But, alas, not on the PC. While it didn't achieve domination, Linux is still preferred by many PC users.

"The march of technological progress will see ever more instances of technology being integrated within ourselves. Augmented humans."

Looking to tomorrow – the next 40 years

ASHTON MILLS ONLY KNOWS HOW TO LOOK FORWARDS, HERE HE MAKES THE BIG CALLS.

Few industries move as fast as ours. Technology is its own multiplicative force. This drives our imagination and, as a result, we've seen time and again science fiction become science fact. Where then will that lead us another 40 years from now? Here's a few predictions from yours truly. Check back in 40 years with your Borg-brain interface, and see if I turned out to be right.

ARTIFICIAL INTELLIGENCE

Sentient AI, once the domain of science fiction, is not only on our map now but actually a lot closer than many people realise. Skynet? HAL 9000? Replicants? It's not a fantasy anymore, merely inevitable (minus perhaps the murderous tendencies of these fictional realisations).

But it won't look anything like our imaginations. General intelligence is still exceptionally hard, and it may take more than 40 years to get there, but before then we will certainly have genre experts – AIs that can reason, think, and make decisions on insurmountable volumes of data to provide solutions that humans never could. They will become advisors, excelling in a focused field such as medical research or production. And, yes, military.

VIRTUAL REALITY/AUGMENTED REALITY

Will revolutionise entertainment and productivity. Miniaturised and beamed directly onto your retina, it's as easy as slipping on sunglasses to see whole virtual words or augmented reality in a different light. Later, special contact lenses project imagery, receiving signals from a device worn over your ear like a Bluetooth earpiece, or embedded directly in your skull.

TRANSPORT

Autonomous cars will be ubiquitous, and many countries will have slowly phased out manual driving – some areas of big cities will be autonomous only, if not entire smaller cities, and be traffic light free: cars will communicate with each other and a central transport AI that optimises the path of every vehicle. It will be cheaper, faster, safer, and cause less pollution – not even taking into account that all cars will be electric.

GENETICS

Farm animals and pets will be genetically engineered – and likely us, too, after the inevitable and monumental moral debates conclude. The benefits are clear: the potential eradication of genetic diseases from the human race. Of course, if we can do this, why wouldn't we also edit our genes to make our children stronger, faster, better...? [cue Daft Punk]. Very likely, we will be able to slow ageing, or even halt it. Now is the time to watch *GATTACA* if you haven't seen it!

BIOHACKING AND TRANSHUMANISM

The march of technological progress will see ever more instances of technology being integrated within ourselves. Augmented humans. It's not as sci-fi as it sounds when you consider pacemakers and hearing devices are part of this today – so just extend this to the potential of miniturised electronics powered ikely by kinetic energy. Embedded communications, improved sight, and more. The excellent BBC show *Years and Years* explores a little of this quite well, another recommended watch. Borg, here we come.

By 2060 the world population will be close to 10 billion and global warming will have re-defined populous coastlines and livable areas. We know now that we acted too late. But maybe we can dream of a better, smarter future.

Coincidentally, in 2058 *The Beatles* catalogue will enter the public domain, assuming that copyright is not extended again. Just imagine... perhaps we will all one day live as one.

REVIEWS

THE HOTTEST GEAR LABS TESTED

From $2,199, asus.com

Asus ROG Zephyrus G14

The last Zephyrus focused its energy on Max-Q GPUs, but this year's reintroduction focusesses on the CPU – is AMD about to take over mobile processor market share too?

AMD has been dominating the desktop CPU scene for the past couple of years now, and while we have seen a couple of interesting AMD-powered mobile devices like Microsoft's Surface Laptop 3 and Asus' TUF Gaming range, and their performance and price was competitive, there seemed to be a number of important features that they missed out on. So while the ROG Zephyrus G14 is the first device we've tested with the new Ryzen 9 mobile processor, we were a little reserved on our initial expectations... which is probably why we ended up so impressed with it overall.

The ROG Zephyrus G14 is a 14-inch laptop designed to be as powerful and affordable as possible, with entry level options starting at $2,199. For this you'll get an AMD Ryzen 7 CPU, a Nvidia GTX 1650Ti GPU, 16GB of RAM, a 512GB PCIe SSD and a 120Hz 1080p screen. While this is a pretty amazing spec sheet for 1080p gaming, there is also the option of boosting the CPU to a Ryzen 9 and the GPU to an RTX 2060 for an expected retail price of $2,799. There's also the option to swap the screen for a higher resolution 1440p display if you're happy to drop back to 60Hz, but the price for this option wasn't available at the time of writing.

When put up against an Intel Core i9-9980HK in an Aorus 17 the Ryzen 9 4900HS is an outstanding performer. The general work and home benchmarks are pretty similar between the two, with both being within 15% either way in simulated day-to-day workloads, but when it comes to raw processing and media encoding the Ryzen 9 was between 16% and 36% more powerful. The Ryzen 9 is also more efficient, offering a 77% bump in battery life under load over the Aorus 17 on the PC Mark 8 Home battery benchmark – a surprising result considering the Ryzen 9 has a higher base frequency (3.0 vs 2.4GHz) and a lower boost (4.3 vs 5GHz). This translates to an excellent eight hours and 24 minutes of 1080p movie playback time (for a gaming laptop), but you can stretch this out further to over 12 hours by manually swapping the display to 60Hz and turning the discrete GPU off in power settings.

It is a pretty amazing feat to get Core i9 performance in a sub-$3,000 laptop, but if you're thinking you'll still get the premium finishes you've seen on previous Zephyrus devices, think again. The top clamshell design has an elegant geometric pattern that cuts across the lightweight aluminium, but things like the display bezels are plastic and the keyboard surround has that cheap aluminium veneer feel to it. The keyboard is fine, but a little mushy, and a webcam is a non-essential luxury for the customer Asus designed the G14 for.

To cap off the machine's stellar performance, the 120Hz display is a killer feature that uses AMD Freesync to render games quickly and clearly. While the RTX 1660Ti will only be able to utilise this on lightweight games, the RTX 2060 should get you well above 60fps if you are willing to drop the 1080p graphics a little. This is one of the best value gaming rigs we've seen in a while.

JOEL BURGESS

Top shelf Ryzen 9 performance and utterly incredible battery life at a really good price.

★★★★★

	PCMark 8 - Home accelerated	PCMark 8 - Home Battery	HWBot x265 - 1080p	Cinebench R20 - multi-threaded CPU	3DMark Time Spy (score)	Total War: Warhammer II - Ultra 1080p (fps Av.)	CrystalDisk Mark Read/ (MB/s)	CrystalDisk Mark Write (MB/s)
Asus ROG Zephyrus G14	4,606	04:13	54.472	4,224	5,799	56	1,760.8	1,754.9
Aorus 17	4,665	02:23	46.746	3,091	9,045	89.3	2,919.2	1,533.4

From $1,599, apple.com/au

Apple MacBook Air 2020

Apple has released its first big update to the Air range since killing off the MacBook, but is this new device good enough to keep MacBook lovers in the Apple ecosystem?

Apple decided to discontinue the MacBook in July last year, so it makes sense to have such a large update to the MacBook Air range this year.

The new MacBook Air range sees a reduction in the base price by $100, so you can get a configuration with a 1.1-3.2GHz dual-core Intel Core i3 CPU, 8GB of RAM and 256GB of storage for the reasonable price of $1,599. If you're doing any more than the lightest of web browsing and document processing you'll probably want to go for the 1.1-3.5GHz quad-core Intel Core i5 CPU, 8GB RAM and 512GB storage configuration for $1,999. This is the first quad core processor on a MacBook Air, so the performance bump will be dramatically larger than that of previous generations. If you want to bolster performance even further then you can upgrade the CPU to a 1.2-3.8GHz quad-core Intel Core i7 CPU for an extra $150, or double the RAM for $300 more and then there are also two additional storage options of 1TB and 2TB, which cost an additional $300 and $900 respectively.

We got our hands on the standard Core i5 variation, which performed well in Geekbench 4 CPU tests, lining up pretty closely with an Intel Core i5-8365U processor on both single core and multi-core benchmarks. This was about 20% behind the score we got using a Core i5-1035G7 on a Microsoft Surface Laptop.

Like the recently released MacBook Pro 16, the 2020 Macbook Air is using a new and improved version of the Magic Keyboard that should be more resilient against dust than some of its predecessors. Apple is claiming that the new Intel Iris Plus Graphics chip is up to 80% better than the Intel UHD Graphics 617 on previous Macbook Airs. Yet again this wasn't great with the Intel Iris Plus Graphics on the Microsoft Surface Laptop 3 netting between 44% and 39% better scores on the two GPU benchmarks we tested.

While Apple hasn't introduced a 14-inch screen to the form factor, it did update the Air range to its Retina Display classification last year and the improved 227 PPI count on the 13.3-inch 2560 x 1600 pixel display looks really good. There's also the keyboard-adjacent upward firing speakers that provide loud and clear audio.

If you're a student the new range of MacBook Airs are slightly cheaper starting at $1,439, and the company is offering 90-day free trials for the Logic and Final Cut suites, for anyone adapting to working from home.

JOEL BURGESS

A decent lightweight laptop with more storage at a reasonable price.

★★★★☆

	Cinebench R20 - CPU (Single-core)	Cinebench R20 - CPU (multi-threaded)	3DMark Time Spy (score)	Battery life - 1080p video playback (h:min)	Peak CPU temperature (°C)	CrystalDisk Mark Read/Write (MB/s)	CrystalDisk Mark Read/Write (MB/s)
Apple MacBook Air 2020	855	347	526	07:55	100	1,153	1,358
Microsoft Surface Laptop 3 13"	1,619	234	861	04:40	100	2446.5	1,245

$2,999, msi.com

MSI Prestige 14

In shooting for the stars has MSI shot itself in the foot? The new Prestige 14 has a premium pedigree, but poor performance.

There's a lot to like about the Prestige 14 – in fact, MSI's latest push into the creator ultrabook realm looks nothing short of awesome on paper. It's got a 10th-generation Intel Core i7 CPU, 16GB or RAM and a dedicated Nvidia GeForce GTX 1660 GPU – which seems like plenty of grunt under the hood. It's not short on looks either, with the option of a vibrant 14-inch 4K HDR screen that offers 100% Adobe RGB colour reproduction and professional-level colour accuracy (Delta E is less than two).

You can grab one of these new MSI Prestige 14 laptops in Pure White, Rose Pink or Carbon Gray, but all of them offer the stylish sophistication that we first saw from MSI in its popular GS series from 2019 (reviewed in *APC* 467). The keyboard is nicely weighted with good travel distance, and the trackpad is spacious and glides under your fingers. It weighs under 1.3kg and it has a 90% screen to body ratio.

The Prestige 14 was designed to handle a solid graphical workload for any content creation tasks where an integrated chip just won't cut it and it should theoretically be capable of playing some games on lower settings in 1080p. While games like *The Division 2* and *Ghost Recon: Wildlands* will run at under 30fps using Ultra 1080p settings, you can get framerate averages of 58 and 74fps respectively on *Total War: Warhammer II* and *Middle Earth: Shadow of War* if you drop settings to low 1080p. But this laptop was supposedly designed for creators, so games probably don't rank high on the priority list.

The wide colour gamut of and high colour accuracy of the display is bolstered by individual factory calibration and Calman colour certification when using the provided colour profile. The unit also comes with multiple Thunderbolt ports to allow you to plug directly into two additional desktop displays without the need for additional hubs. On the far side it's also got two Type-A ports for peripherals or external storage, a microSD Card slot and audio jack to make a well-rounded connection profile. While we did have some issues when we turned on the internal HPET timer, generally the Intel Core i7-10710U CPU performance was in-line with what we expected, showing comparable working performance to an i7-9750H CPU on a Dell XPS 15 OLED. This did drop in raw processing performance and media encoding, with the new 10th gen chip offering 45% lower performance – a surprisingly large result considering both chips are hexa-core.

The Prestige doesn't have a perfect thermal design, however. The CPU has a boost frequency of 4.7GHz, and the chassis is just 1.6cm thick which doesn't leave a lot of room for heat sinks and means that the chip can't boost for quite as long as it theoretically could. A lot of the heat actually radiates from just above the keyboard, so you need to be careful to not burn yourself when doing demanding tasks. Battery life was also pretty disappointing, with the unit only lasting two hours and 37 minutes in PCMark 8's battery life benchmark, and just 30 minutes longer for 1080p movie playback.

JOEL BURGESS

A decent thin and light creator laptop that could have better thermals and battery life.

★★★½☆

	PCMark 8 - Home (score)	Cinebench R15 - CPU (multi-threaded)	HWBOT x265 - 1080p (avg fps)	3DMark Fire Strike (score)	Ghost Recon Wildlands - Ultra 1080p (fps Av.)	CrystalDiskMark Read (MB/s)	CrystalDiskMark Write (MB/s)	PCMark 8 - Home Battery acc. (hh:mm)
MSI Prestige 14	3,514	575	18.522	6,149	20	3,371	3,091	02:37
Dell XPS 15 OLED	3,377	1,103	34.582	8,118	26	2,900	2,830	04:07

$749, www.tp-link.com/au

TP-Link Deco AX3000 Mesh Wi-Fi system

A Wi-Fi mesh for mega mansions.

Over the past few years, TP-Link has greatly impressed us with its well-designed, well-built products, that are simple to set up and use, come with reasonable price tags and often showcase the latest Wi-Fi technology before the competition. Here's its latest three-node mesh kit, which uses Wi-Fi 6 meaning there really shouldn't be any coverage / performance black spots left in any reasonably large premises. So, should you buy it?

The kit can either be used as a standalone router or access point that boosts coverage from your existing router. As with most mesh systems, set-up is simple and revolves around downloading TP-Link's Deco app, which locates and automatically configures your primary node. We found that simply turning on the other nodes was enough for them to be automatically added to the mesh but you can add them manually through the app too.

However, once they're added you can't easily check on whether they're individually functioning properly without looking at each one's status LED. With each node capable of large coverage, we didn't notice that our second node had accidentally been unplugged because the signal from the first was so strong. This immediately poses an existential question to a Wi-Fi 6-based mesh – with individual Wi-Fi 6 routers so powerful, do you really need one when individual routers can cover reasonably large premises on their own? The answer is printed on the front of the box: this system covers "7,000 square feet" which equates to "4 to 7+ bedroom houses" i.e. mansions.

To date, we've been recommending two Wi-Fi products for most premises: TP-Link's Archer AX6000 router which easily covers three-to-four bedroom residences, or Asus' ZenWiFi kit when you need a gaming quality connection on a PC that's the other end of a house to your router. That said, how did this perform?

We downloaded large video files from a Synology DS1019+ NAS to a Wi-Fi-6-equipped Dell XPS 15 OLED laptop in a three-storey Sydney Town House, next to the nodes, at ground level, one floor up and two floors up. It averaged transfer rates of 253Mbps, 148Mbps and 119Mbps, respectively. While these aren't bad for general web browsing and video streaming over Wi-Fi, they're slow for Wi-Fi 6. Asus' ZenWiFi mesh-router combo managed 427Mbps to the second floor and that used last-gen AC Wi-Fi. Frankly, we're disappointed.

Analysing the transfers suggested that maintaining a strong connection was a struggle for the nodes but even then, peak speeds were a long way off Wi-Fi 6 expectations.

Beyond performance there's still much to like. The usual features are all simple to access and set-up using the app. There are decent QoS controls, plus good traffic monitoring, internet security and family controls built-in.

At $749 it represents a hefty investment and because of the speed issues we can't recommend it for buyers wanting to fill a family-sized premises with Wi-Fi because there are many, similar performing, cheaper, AC-based alternatives. However, if you have been struggling for basic coverage in your mega mansion, it might be just what you're looking for.

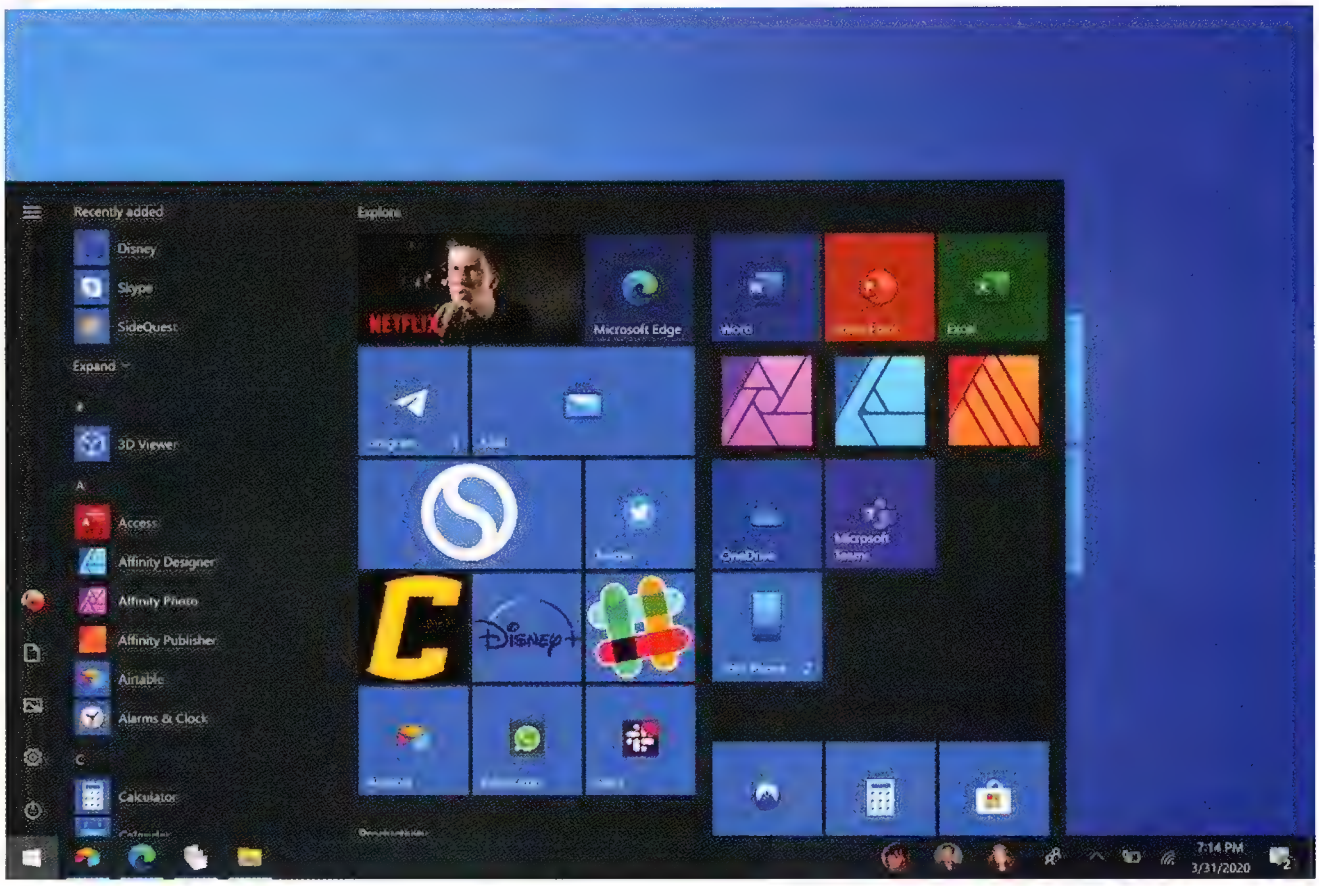
NICK ROSS

SPECS

Speed: AX 3,000Mbps | Connectivity: 3x (2 Gigabit Ethernet) | Features: TP-Link Homecare security and family controls, Alexa compatible

Wide coverage is marred by poor performance and a high price tag.

★★★☆☆



WINDOWS, US$6, Microsoft Store

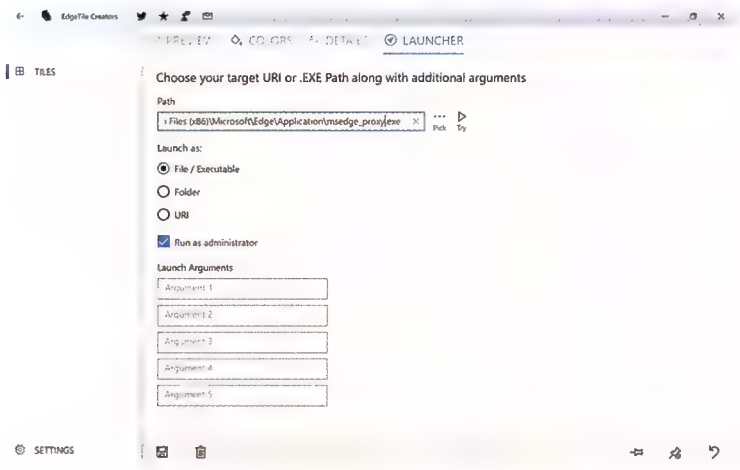
EdgeTile Creators

Making custom tiles to spice up your Start Menu.

Because Windows 10 supports so many different types of applications, you can end up with a variety of Start Menu icon styles on your PC. UWP apps appear one way, Win32 programs appear another way, and progressive web apps (PWAs) have their own style. This results in an inconsistent Start Menu with icons of various sizes and styles. EdgeTile Creators aims to fix that by allowing you to create custom tiles for just about anything. It works with files, folders, websites, and apps. It can even work with progressive web apps, but that takes more work than it should.

In addition to unifying the style of your Start Menu tiles, EdgeTile Creators is a helpful tool to swap out logos you don't like. For example, I prefer the old Slack logo over the new one, so I created a custom tile with the old Slack logo that opens up Slack.

Achieving a uniform and consistent look to Start Menu tiles is just one goal – full customisation is also on offer with EdgeTile creators.



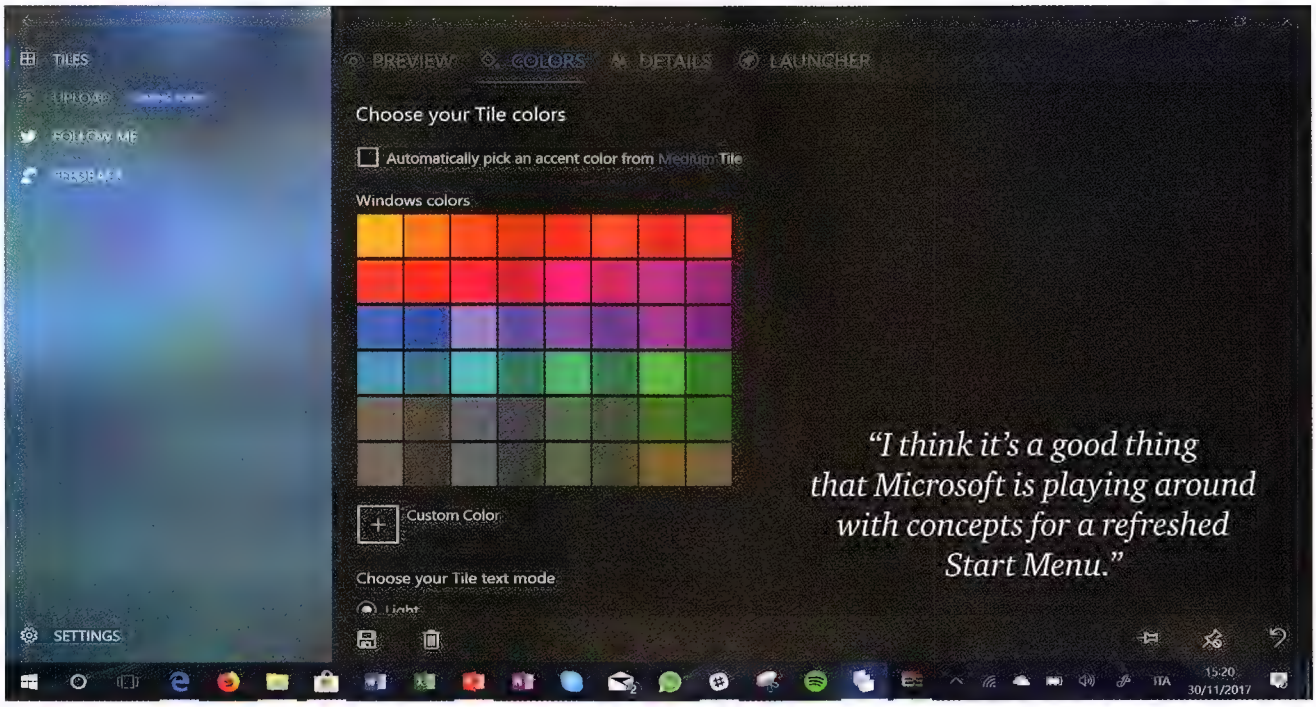
A cumbersome interface and often painfully obtuse commands get in the way of uability.

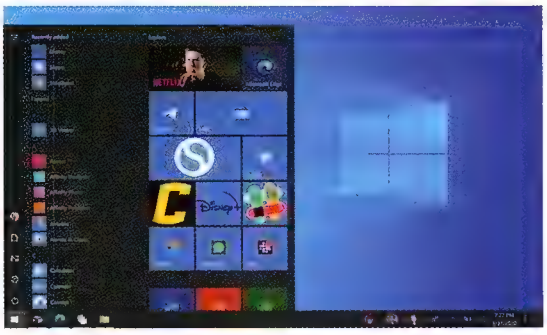
What you'll love about EdgeTile Creators

I think it's a good thing that Microsoft is playing around with concepts for a refreshed Start Menu. In my opinion, the entire thing requires a refresh. Icons from different types of apps show up with different sizes and styles. It's far from elegant, and the concept shown off recently looks much better than what we have now. EdgeTile Creators can't change everything about your Start Menu, but it can change the icons within it.

Pinning files, folders, and websites to your Start Menu is easier than pinning other content such as programs or PWAs. You can click to create a tile, pick the images you'd like, and then pick the path for the tile. You can also customise aspects of each tile, including if it should show text and the background colour you'd like.

When you click the tiles from the Start Menu, you don't see a splash screen. I didn't break out a stopwatch, but they didn't seem to launch any slower than tiles created by Windows.





TOP: The UI does shine in some areas, keeping things as simple as they should be.

It takes a bit of time, but with EdgeTile Creators, you can create tiles for all of your favourite content and customize the icon of the apps and programs you regularly use.

What you'll dislike about EdgeTile Creators

While EdgeTile Creators can create custom tiles for programs, apps, and progressive web apps, it takes a lot of effort to make some of them work. To launch an executable file, you need to pick its path, and in some cases, you need to add several arguments to make it work.

I was frustrated by the setup process to make a progressive web app that's installed through Edge work with a custom tile. While you can just create a tile that opens up a website, that website opens within your default browser. I have several PWAs and other websites installed through Edge, including Disney+, Slack, AirTable, and WhatsApp. Creating a custom tile for each of these involved a complex process of finding the shortcut for the app, copying it's target into EdgeTile Creators, and cutting specific parts of the target data into different arguments.

The app needs a cleaner way to add programs and progressive web apps. People shouldn't have to dig through specific code within target data to make a custom tile. For example, please look at the text below that's needed to make a custom tile for Disney+:

`"C:\Program Files (x86)\Microsoft\Edge\Application\msedge_proxy.exe" --profile-directory=Default --app-id=mbjafbmjpcimpkkihihoideiofnoalmh`

I doubt many people would know how to break that up to make it work with EdgeTile Creators. The answer is that you need to:

1. Take the first part in quotes, in this case, `"C:\Program Files (x86)\Microsoft\Edge\Application\msedge_proxy.exe"` and place it within Path (note, you have to remove the quotes)
2. Take the last part of the line, including the two dashes into Launch Argument 1. In this case, it's `"--app-id=mbjafbmjpcimpkkihihoideiofnoalmh"`
3. Take the middle part, including the two dashes, and place it inside Launch Argument 2. In this case, it's `"--profile-directory=Default"`

Should you buy EdgeTile Creators?

It's tough to say if EdgeTile Creators is worth it right now. On the one hand, it allows you to customise all of your Start Menu icons, whether they lead to folders, files, apps, or websites. On the other hand, it takes some awkward steps to make some of those work.

I initially reviewed EdgeTile Creators a few years ago, and at the time, gave it a 4/5. But PWAs have come around and grown in popularity since then, so being able to pin them to the Start Menu in a way you like has become more critical.

If you're tech-savvy enough to follow the steps to create the custom tiles you need, then EdgeTile Creators is worth $6, in my opinion. You probably interact with the Start Menu quite a bit throughout the day, so making it look nice could be worth a bit of money and effort. If you want to make a bunch of tiles for PWAs and don't want to deal with the steps above, I wouldn't grab EdgeTile Creators. Maybe an update could streamline the process and make it more worth it for casual users.

SEAN ENDICOTT

Make custom Start Menu tiles for files, folders, programs, and websites. It works with progressive web apps, though it takes a bit of work.

★★★☆☆

MACOS 10.13 or later, US$129, telestream.net

ScreenFlow 9

Create slick videos with this clever editing package.

ScreenFlow is a screen capture and editing package that lets you create screencasts, which have become increasingly popular in our always-on world. While QuickTime has basic screen recording tools, ScreenFlow is much more advanced with animation, titling, graphics and 'callout' tools, amongst other things, to let you create professional-looking and sounding videos.

To its already-impressive feature set, version 9 adds some new tools to improve workflow. To begin with, there's the customary under-the-hood improvements that ensure compatibility with the latest version of macOS, and the graphics cards in the most recent Mac models. Although ScreenFlow is very user-friendly, the technology behind high-resolution screen recording is complex, so it's always good to have the latest version.

The headlines

The first headline new feature is multi-screen recording – when creating a new project you can choose to record from more than one screen, which is very helpful for showing multiple apps without having to juggle windows. Next is a new tool palette containing hand, zoom, blade, and track select tools. Arguably somewhat overdue, this is still a nice addition and tools can be invoked using simple keyboard shortcuts, which quickly become second nature.

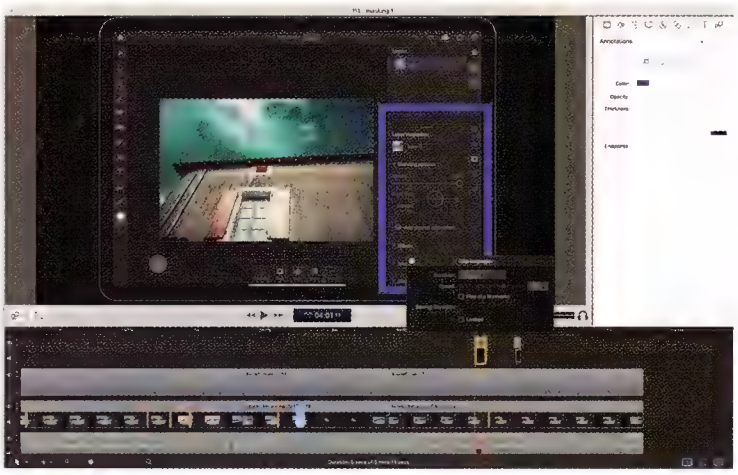
Proxy editing, which can be toggled in the Preferences section, enables you to edit high-resolution images without taxing your Mac too much – perfect for slower systems. When you export, the full res versions are used so you don't lose quality. There's a new clip editor that works much like Adobe Premiere, where you can double-click on a clip from the library and set its start and end points before dropping it into the timeline, saving time resizing it after you do. Finally, new click effects with more animation options help you more clearly illustrate your mouse movements.

Despite a couple of minor niggles – its handling of third-party audio plugins still leaves something to be desired – ScreenFlow remains the best way to create and edit screen recordings on your Mac.

HOLLIN JONES

One of the longest-serving apps is still among the best with another solid update.

★★★★★



Add callouts and graphics such as animation, touch and gestures to illustrate your points more clearly.

Record your desktops or iOS devices, and pre-edit clips before they hit the timeline.

LINUX, www.untangle.com

Untangle NG 15

We're always a sucker for pretty graphical interfaces.

Untangle is one of several firewall appliances, but it stands out for its intuitive interface and an impressive portfolio of add-ons. Like all of its peers Untangle is designed to take over the entire disk, which makes it pretty easy to set up. On the downside, though, you can install the latest version on 64-bit machines. This is especially frustrating since the distro has modest requirements and repurposing an old 32-bit machine as a gateway server is one of the best uses for pushing underpowered hardware back into active duty.

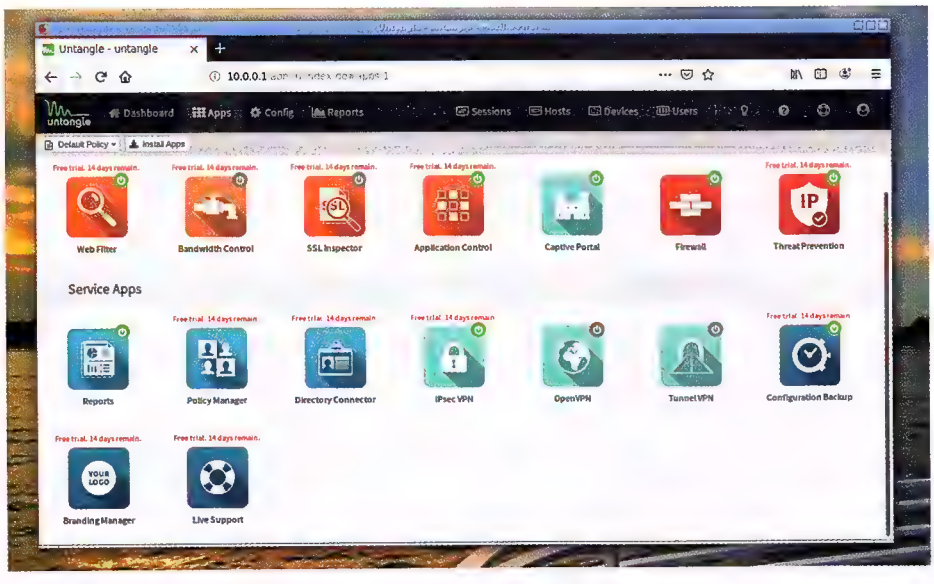
We tested Untangle on a machine with two network cards; one connected to the internet and the other connected to the local network. Untangle calls this the Router mode, in which it acts as the router and the firewall. While this is how most people would use a firewall appliance, you can also deploy Untangle as a Transparent Bridge, so that it sits between the existing firewall and the internal network.

When setup is complete, Untangle prompts you to create a free account with www.untangle.com. While you can skip it and head to the dashboard, know that you'll need the account for several critical tasks, such as for installing plugins. Untangle doesn't ship with any components preinstalled, so you can't do much with it without registering. As soon as you register, the distro offers to install a recommended set of packages for you. If you agree it'll install over a dozen applications and services, including: a web filter; virus blocker; spam blocker; bandwidth control; application control; captive portal; WAN balancer; and a firewall, among others. Some apps that Untangle doesn't install are an ad blocker, spam blocker, virus blocker, web cache and some others.

Hey good lookin'

Once the server has some apps, it'll take you to a smart-looking dashboard. With over a dozen widgets, the dashboard helps you to analyse the traffic passing through the server and also gives out all sorts of stats. Admins will also appreciate the Reports app that monitors and prepares detailed and visually appealing reports about the server, as well as its different components.

"Almost all the apps are preconfigured and run automatically after installation. If you want to manually configure them you can do so from under the Apps tab in the dashboard."



You can configure Untangle to update itself, and then use the web interface to customise the schedule for the updates.

Almost all the apps are preconfigured and run automatically after installation. If you want to manually configure them you can do so from under the Apps tab in the dashboard. Again, the interface makes the task pretty intuitive. For instance, the Firewall app makes the task of defining rules for firewalling traffic relatively straightforward and simple. Even the task of defining complex rules to get granular control over the network traffic by combining multiple parameters is made accessible with the use of relevant pull-down menus.

The alerts section of the Firewall app has been enhanced in this release. The Web Filter app also gets a new option that'll redirect all searches in popular search engines through **www.kidzsearch.com** in order to sanitise the results for children. The major new addition is the inclusion of the Threat Prevention app that'll help thwart threats from untrustworthy IP addresses.

The new app is included as a 14-day trial. In fact many apps, such as Web Filter, Bandwidth Control, and Policy Manager are 14-day demos that'll need to be purchased. You can buy the apps individually or get them all as part of the NG Firewall Complete package that starts at US$25/month. But even without the paid apps, Untangle retains its powerful firewalling features, along with several useful apps including Reports, Captive Portal, and OpenVPN.

While we love its intuitive interface and can't find any technical faults, consider the fact that you can get similar functions from its peers without paying the premium. But if you don't mind paying for Untangle's point-and-click configurability, you'll surely get your money's worth.

MAYANK SHARMA

While many of its features are paid apps, even without them Untangle has the hallmarks of a powerful firewall appliance.

★★★½☆

tp-link | deco

Wi-Fi 6

Work From Home In Any Room

Next Generation Whole Home Mesh Wi-Fi System

WORKS WITH amazon alexa

Deco X60/X20

Wi-Fi Dead-Zone Killer

Seamless Roaming

TP-Link HomeCare™

Works With Any Device

Available in 3 pack

Attention: This device may only be used indoors in Australia and New Zealand. A registered trademark of TP-Link Technologies Co., Ltd. Other brands and product names are trademarks or registered trademark of their respective holders. Copyright ©2020 TP-Link Technologies Co., Ltd. All rights reserved.

Please visit and check: https://www.tp-link.com/au/home-networking/deco/

FEATURE

THE FIRST 30 MINUTES WITH YOUR NEW PC

TREATED YOURSELF TO A NEW COMPUTER? NICK PEERS REVEALS HOW TO GET IT UP AND RUNNING.

You've done it: you've finally replaced your venerable, but creaking PC with a new shiny model. Perhaps the end of support for Windows 7 has forced you to make the move to Windows 10, or perhaps you're switching from one form factor (laptop) to another (desktop). Whatever your reasons for doing so, the process of transitioning involves several steps that you may not already be familiar with.

This issue we're going to not simply sit with you for the first 30 minutes of your new PC's life, helping you get yourself set up in Windows, we'll also help you migrate everything you need from your old PC to new: files, settings and applications will all make the journey across. You'll discover what to do with applications that no longer work in the latest version of Windows, plus we'll examine if now is the perfect time to keep your personal data separate from your system drive, adding an extra layer of protection for your data.

Speaking of protection, we'll complete the migration by performing a thorough security audit, ensuring your new PC (as well as your personal data) is as secure as it can be before putting into place a robust backup mechanism for additional peace of mind. Enough tittle tattle, it's time to board the migration train, departing to New PCville in five, four, three...

PART 1

First steps in Windows

Your first task is to get the operating system set up and your basic user settings in place.

Your first steps with your new PC will vary slightly according to the route you've gone down. If you've purchased a laptop or off-the-shelf desktop PC then you'll find Windows 10 will be installed, but paused at the initial setup process. If you've built your own PC and purchased your own copy of Windows, then obviously you'll need to install that from scratch.

Ready, get set...

After switching on your new computer, you should be taken through the Windows 10 post-setup process where you'll probably be asked to confirm your country and region, connect to your Wi-Fi network and sign into Windows using your Microsoft Account. If you're coming from Windows 7 this may require clicking 'Create account' if you've not already got some form of Microsoft account (for example, a free Outlook email address or OneDrive account).

If you're determined to retain a local user account at this point, click 'Offline Account' followed by 'No' create the same kind of user account as you had in Windows 7. One important point to remember: you'll need a Microsoft Account to access certain features, including the Microsoft Store for Windows 10 apps, and Windows may automatically convert your account to a Microsoft Account without telling you when you connect your account for any reason.

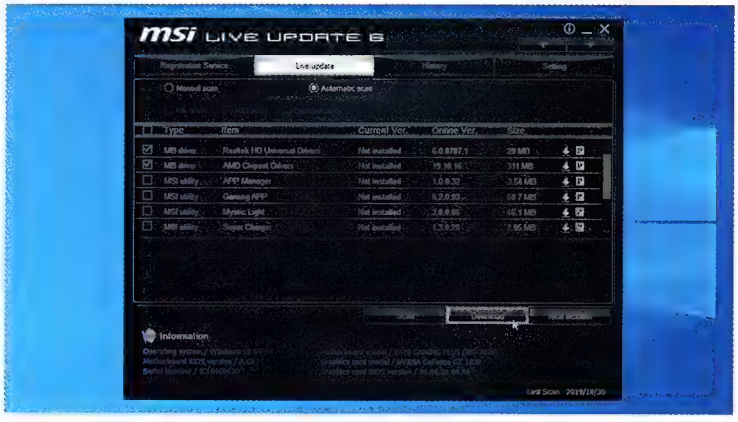
After setting up your account, assign a PIN number for faster logins and then choose whether to link your OneDrive account to this PC, which is one way to transfer files from your old PC to new (more on that over the page). You'll also be subjected to a series of screens offering features like the Cortana voice assistant and online speech recognition. All of these come at the cost of personal privacy, so if in doubt, leave them disabled. Finally, you should find yourself at the desktop.

Critical steps

Before embarking on the process of transferring programs, data and settings from your old PC, you should take the time to make sure everything's shipshape and ready to go. First, navigate to Start > Settings > Update & Security where you should find a raft of updates waiting for you. Install these and keep checking back for other updates too – consider clicking 'Advanced options' to flick the switch to receive updates for other Microsoft products when you update Windows.

Next, consult your PC's documentation to see if it comes with any additional tools and updaters – for example, installing proprietary driver updates over and above those offered by Windows itself, such as the HP Support Assistant. Speaking of which, your pre-built PC is likely to come with a load of unwanted extras in terms of bloatware – you should be able to get rid of these via 'Settings > Apps > Apps & features' or try IOBit Uninstaller Free (**www.iobit.com/advanceduninstaller.php** - skip any additional program offerings during the install process). Here, focus your search on Bundleware and also look under Toolbars & Plug-ins for unwanted browser addons to help clean your new PC before you start adding your own software.

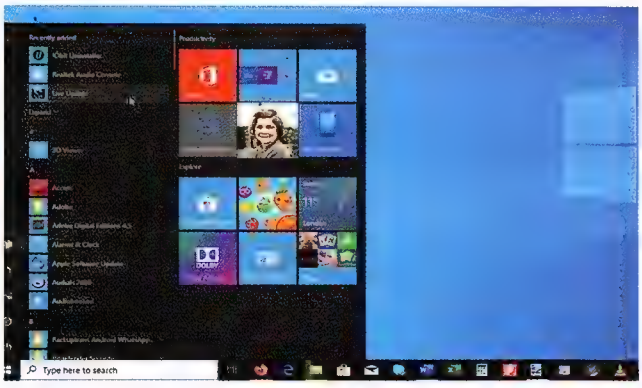
Remove unwanted programs installed by your new PC's manufacturer to free up space and system resources.



Source your own drivers

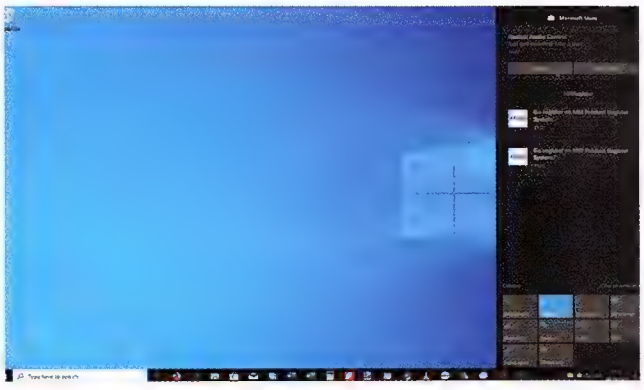
If you've built your own PC, you may need to install drivers yourself from various sources – start with your motherboard's manufacturer. Look out too for related utilities – for example, MSI Live Update for MSI motherboards – that can simplify the sourcing of drivers (and subsequent updates) for you. Repeat for other core components – including your graphics card – before moving on to your peripherals like your printer or game controller. Struggling to find them all? Consider installing Driver Booster 6 (**www.iobit.com/en/driver-booster.php**) to seek out drivers across your entire system, including updates not normally detected by Windows Update.

EXPLAINED: Differences between Windows 7 and 10



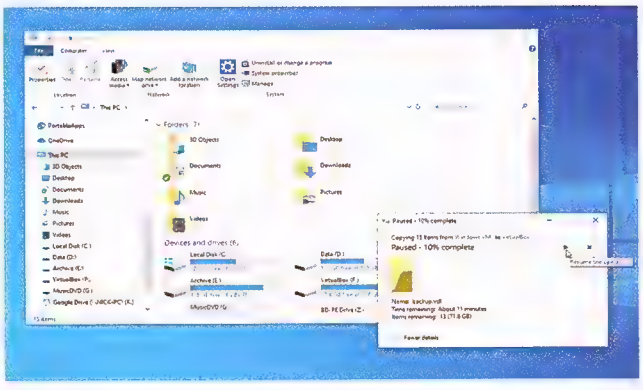
01 DESKTOP CHANGES

The Windows 10 desktop is only superficially different to Windows 7, but there are some key changes – the Start button opens a new Start menu, plus if you right-click Start or press Win-X you'll reveal a hidden Start menu with more advanced options.



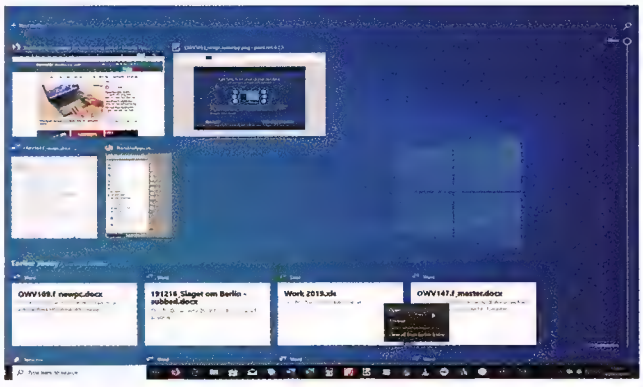
03 NOTIFICATIONS REPLACE ACTIONS

The Action Centre is no more – instead, make a note of the speech bubble icon to the right of the Taskbar notification area. Click this to slide out the Notifications Centre where you can read alerts, plus access a selection of quick-action buttons for common tasks.



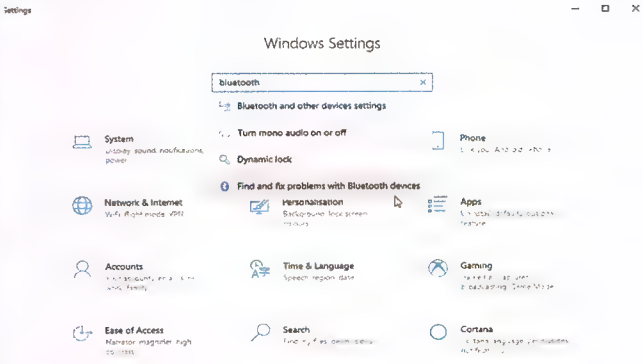
05 REDESIGNED FILE EXPLORER

The new-look File Explorer – in our opinion – is far superior to Windows 7's file management tools. The ribbon menu places key features within easy reach, while a new file copy dialogue box allows you to both monitor and pause/resume file transfers.



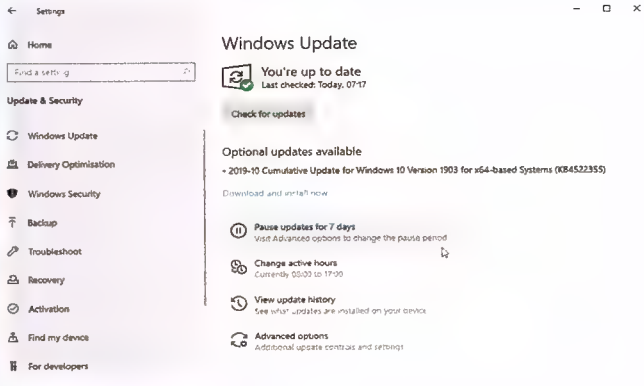
02 SEARCH YOUR PC

Click inside the Search box next to the Start menu to search your PC (and the wider web) for files, programs, settings and more. Next to this is the Task View button: click this to organise your virtual desktops (up to four) and reopen old programs, windows and documents.



04 WHERE'S THE CONTROL PANEL?

The Control Panel is still hanging on, but hidden away: most of its features are now housed in the modern-looking Settings pane, accessible via the Start menu. A handy Search button makes any setting easy to find – including shortcuts to those features still only found in the Control Panel itself.



06 WINDOWS UPDATE

The days of picking and choosing your updates is over – however, you can now pause updates for up to 30 days after their release. To do this navigate to 'Settings > Update & Security' to pause in seven-day increments. Windows 10 Pro users should click 'Advanced options' for more flexible options.

PART 2

Move apps and settings

Discover how to move your favourite programs from old PC to new – complete with settings intact.

The next step with your new PC is to set up all your favourite applications, plus transfer across your carefully crafted settings from your old PC. Before going any further, we recommend taking a drive image of your old PC's system drive using Macrium Reflect Free (**www.macrium.com/reflectfree.aspx**).

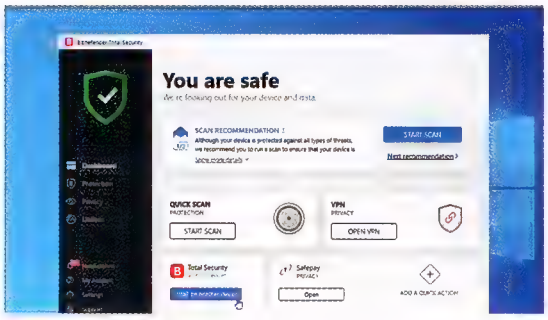
Save this image to your backup drive, then install Macrium on your new PC and take a drive image of its hard drive as your baseline backup: Windows 10, all updates and key system utilities only. Should you need to roll back for any reason, you'll save yourself time by skipping the previous section's instructions. Plus, with Macrium installed, you can mount your old PC's drive image as a virtual drive to access any missing files – more on that over the page.

Reinstall key apps

If you're short on time, and willing to pay around $100 for the privilege, check out the box below for a program that can migrate everything you need – programs, settings and data – across from your old PC. If you're happy to spend a few hours, however, you can do the job by hand and choose which programs to keep and settings to apply.

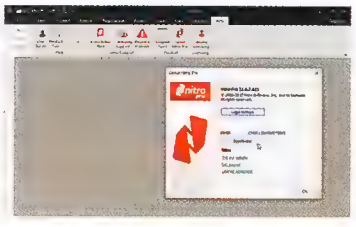
Let's start with the basics: your security software. If you're using Microsoft protection then skip to the next paragraph, otherwise either download the latest version of a free tool from the venor and install that, or check your paid-for package's license terms. Most offer three or five-PC licenses as standard, so you can install it on your new PC without having to first deactivate your old PC.

If you do need to transfer the licence, look for an option within the security software's main panel to access your account settings. This will often take you to an online portal where you can deactivate the licence on your old PC before activating it on the new one. Next, install your web browser. Looking for a new start? We recommend Firefox (**www.getfirefox.com**), but most modern browsers now feature a sync tool whereby you can keep all your settings – including bookmarks, addons and tab histories – across multiple devices. If you've not already set up sync on your old PC, do so now. Once synced to the cloud, install the browser on your new PC and sign into the same account to sync your settings across. Job done.



Check your security tool's central interface to see if you have a spare slot to install it on your new PC.

You can now continue to install new apps – some, like Adobe CC apps, require activating, so be sure to deactivate them on your old PC before installing them on your new machine. If you've upgraded from Windows 7 to Windows 10 then you may discover some older apps no longer work – this may be because you have an older version (check the website to see if a later version



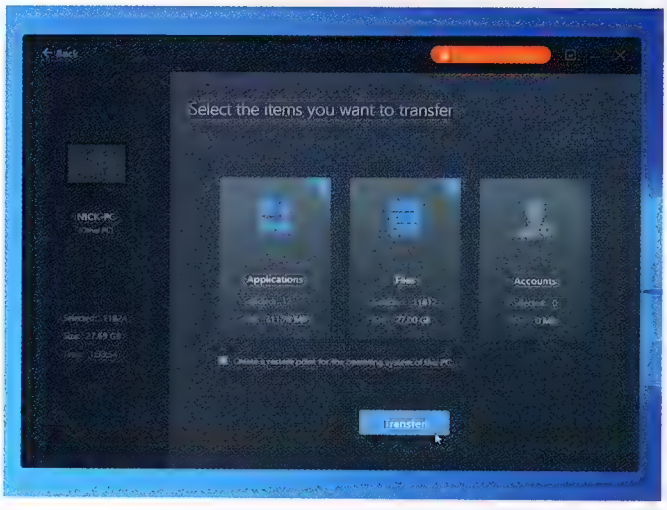
Some programs will require deactivating on your old PC before you can use them on your new one.

Fuss-free program transfers

If you simply want to transfer everything (possible) across from old PC to new, and aren't worried about paying for the privilege, then take a look at EaseUS Todo PCTrans (**www.easeus.com/free-pc-transfer-software/**). This program makes it easy to transfer across programs, settings and files from old PC to new – you can transfer directly via your network or create an image file on your old PC that is subsequently transferred across and restored to your new computer.

To transfer this data over your local network, download and install the program on both machines, then choose PC to PC on either machine, select your other PC and enter your user password. Choose which direction the transfer should take, then wait for the files, setting and data to be analysed. Finally, choose what to transferm then sit back and let the program do its job.

A cut-down free version lets you take the program for a test drive, with support for transferring up to two applications and settings from one PC to another. The Professional version removes these limits and costs US$49.95.



If you're willing to pay, you can transfer all your apps, settings and data from your old PC to the new one with a single app.

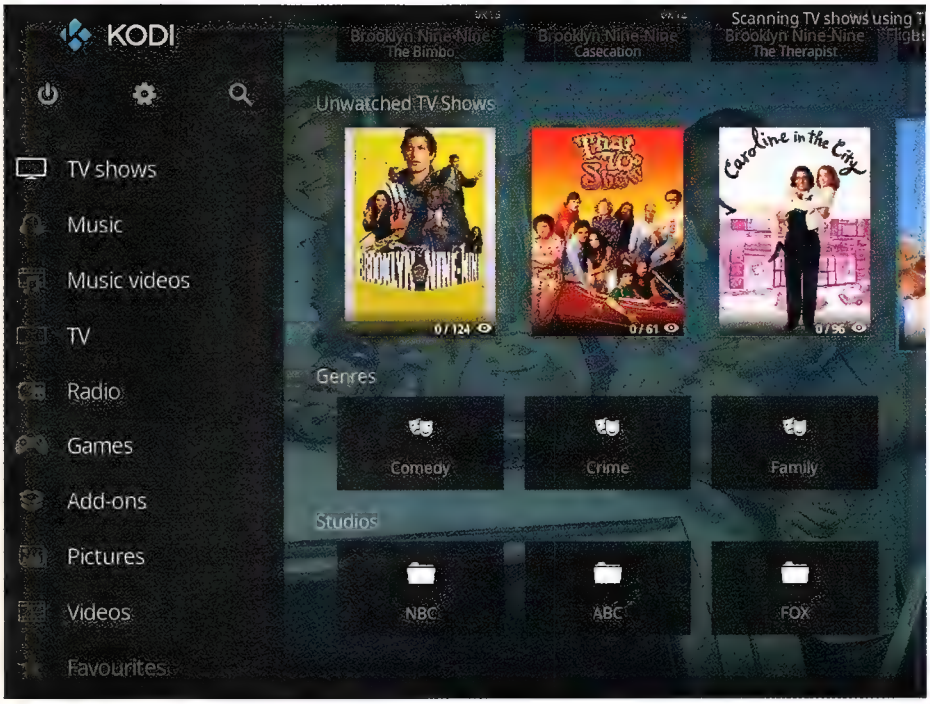
supporting Windows 10 is both available and affordable), or visit the website **https://alternativeto.net** to type in your old program name and discover what alternatives exist – both free and commercial.

Some programs to consider: LibreOffice (**www.libreoffice.org**) replaces Office 2010 or earlier, while Paint.NET (**www.getpaint.net**) or The GIMP (**www.gimp.org**) can replace Photoshop. Windows 10 also removes some key functionality from Windows 7 – missing Windows Media Center? Kodi (**www.kodi.tv**) is your closest equivalent, while LEAWO Blu-ray Player (**www.leawo.org/blu-ray-player/**) is perfect if all you need is a standalone DVD or Blu-ray player.

Transfer settings

Some programs sync their settings between PCs using a similar account-based system to your browser – log in on your new PC to see if your preferences have magically appeared. Other programs may be able to save your settings – explore their options or preferences or check their website. If you're running portable apps, then simply copying the program folder across to your new PC should ensure their settings follow them across.

For those programs that don't offer such services, try CloneApp (**www.getclone.app**). The three-step walkthrough cover its key features – note that when



Kodi is the perfect replacement for Windows Media Center for viewing content and can play DVDs too.

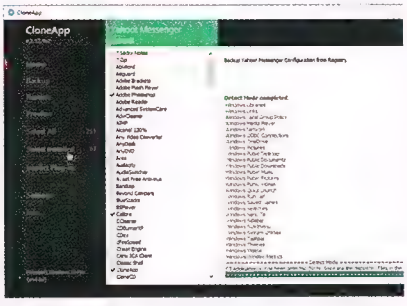
'restoring' it'll restore everything you backed up previously, so be sure to only back up those settings you want to transfer across. We recommend downloading and familiarising yourself with the product manual (**www.getclone.app/downloads/ca_docs/manual.pdf**) before using it.

If you can't find a specific program setting, then try visiting its website to see if anyone has documented what Registry keys or configuration files (including their location) are required, then manually copy these across.

If all else fails, you might want to simply go through the dialogue boxes taking careful notes of key settings to manually set up your new PC in the same way.

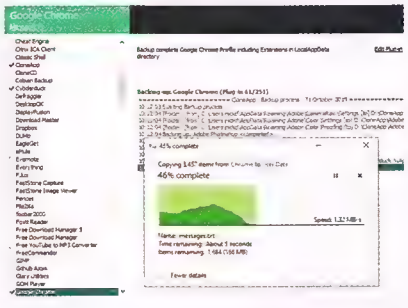
"If you've upgraded from Windows 7 to Windows 10, you may discover some older apps no longer work"

HOW TO: Transfer settings with CloneApp



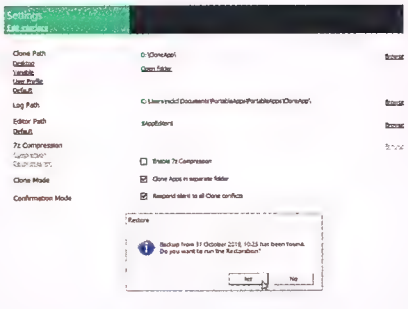
01 SELECT INSTALLED APPS

CloneApp is a portable app – after downloading on to your old PC, right-click CloneApp.exe and choose 'Run as administrator'. Click 'Select Installed' to tick all the supported programs and Windows settings that have been detected on your PC.



02 BACK UP SETTINGS

Go through the list, clicking on an item to see what gets backed up, and adding or removing programs as required. Once complete, click Backup – make a note of the backup location and click Yes, then wait for all your settings to be backed up.



03 TRANSFER TO NEW PC

Once complete, transfer the entire CloneApp backup directory to your new PC, plus download a fresh copy of CloneApp to run on your new PC. Launch that and choose Settings. Click Browse next to Clone Path to select your backup directory, then click Restore.

PART 3

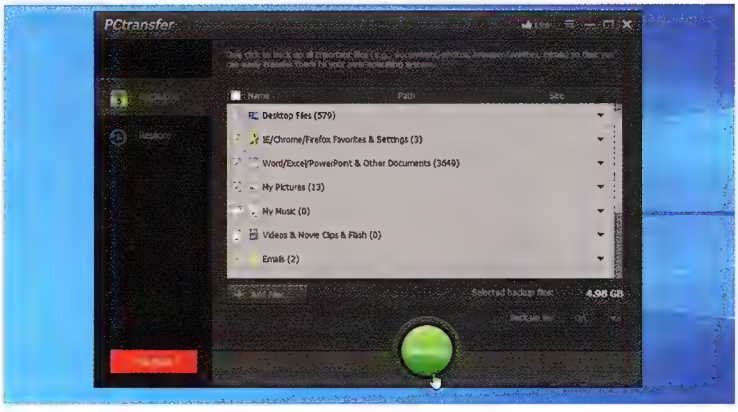
Move data to a new PC

Time to move all your precious files from your old computer to your new one without leaving any behind.

When transferring programs and settings using CloneApp you may have already transferred some of your data too – specifically files stored in supported cloud-based folders like OneDrive and Dropbox. Transferring them this way before setting up your cloud sync accounts is actually a good idea – it's quicker (and uses less internet bandwidth) for your new PC's installation to compare all the files you've copied across with the copies in the cloud rather than download a fresh copy of them all to your PC, which could literally take days if you've hundreds of gigabytes to transfer.

Even if your cloud provider isn't supported, don't rush to install and sync just yet. You can transfer those – and other files – using several alternative methods, but first stop for a moment and look at your new PC. How many hard drives does it have? Most come with just one physical drive installed – if it's 256GB or larger, then why not take advantage of the fact it's currently relatively empty and partition it in two?

Partitioning allows you to store your data on a separate drive to Windows and your programs as if you had a second physical disk installed. The benefit is obvious: if Windows crashes, it won't take your data with it – although you should still back up your data separately to another drive in the usual way. Partitioning only works if you have a large enough drive: you'll want to leave a minimum 64GB (and preferably 128GB or larger) partition for Windows and all your apps. If your PC fits the bill, follow the step-by-step guide.



IObit PCTransfer works in two stages: back up old PC's files, then restore to new PC.

Don't forget to update your old backup if you plan to use it to transfer data across.

Transfer files manually

You can, of course, transfer files manually via an external drive or over the network – focus your search on your user folders but do take the time to explore other parts of your old PC's drive for files that have been stored elsewhere. If in doubt, heed our earlier advice and use Macrium Reflect Free to take a fail-safe image of your old PC's drive – the box below reveals what to do if you need to recover a file you missed.

Another way to transfer data

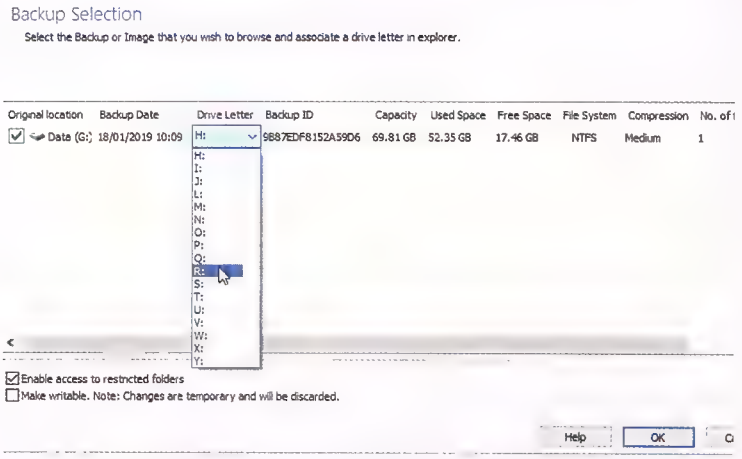
Recover forgotten files

What happens if, having transferred your files and disposed of your old PC (see over the page), you discover that you forgot to copy across a key file or setting? This is where that fail-safe Macrium Reflect backup we recommended you take earlier comes into its own.

You can mount this as a virtual drive on your new PC in File Explorer, then copy any missing data from it to your new PC.

To do this, install Macrium on your new PC if you haven't already, then navigate to the drive image file and double-click it. Allow Macrium to launch, then place a tick next to the drive or drives and make a note of the drive letter each is going to be assigned (you can change these by clicking the appropriate drive letter). Tick 'Enable access to restricted folders' and click OK.

From here, just browse the virtual drive(s) like any other in File Explorer, copying any folders or files you missed to their equivalent locations on your new PC.



Take drive images of your old PC's hard drives, and you'll always have access to your old files. You just need somewhere to store them, such as an external hard drive.

from your old PC to new with the help of IOBit PC Transfer (**www.iobit.com/en/pctransfer.php**), a free portable tool that automatically collects together certain files (thus ensuring you're less likely to miss any) while allowing you to manually select additional files and folders too. It's a two-part process: run it on your old PC to transfer your data to a backup drive, then repeat on the new PC, this time choosing Restore to copy everything to your new computer.

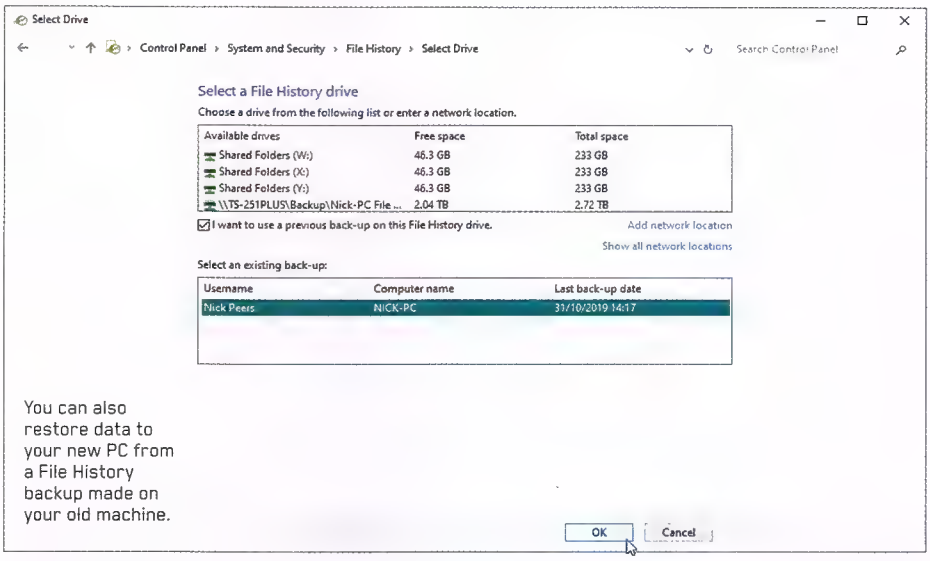
Restore from backups

Other files can be transferred one of several ways. If you're switching from Windows 7 and have been diligently using the Backup and Restore tool to back up your key files, run it one last time in Windows 7 to bring your backup bang up to date, then copy the backup to an external or network drive if necessary.

Switch to your new PC and navigate to 'Start > Settings > Update & Security > Backup', clicking 'Go to Backup and Restore (Windows 7)'. Choose 'Select another back-up to restore files from' to locate your old PC's backup file, and then follow the wizard to decide what files to recover and where to put them.

If you were using File History on a newer Windows 8.1 or 10 PC, again make sure the backup is on a drive visible to your new PC. This time, however, type 'control panel' into the Search box, click Control Panel and choose 'Save backup copies of your files with File History' under System and Security. Do NOT switch File History on at this point; instead, click 'Select drive' and if necessary 'Add network location' to connect the drive containing your old PC's backup. Select this and you should see an option to select a previous backup to reconnect to it: tick 'I want to use a previous back-up on this File History drive'. You should see your old PC backup appear – make sure it's selected and click OK. File History can now run – let it create a 'backup' of your new PC (which won't take long) to complete the link.

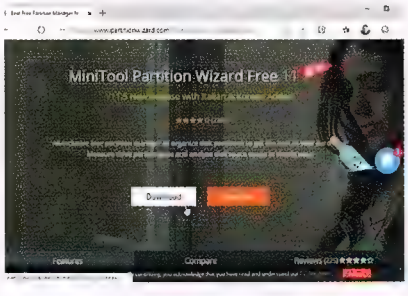
Now close Control Panel and type 'file history' into the Search box. Click 'Restore your files with File History' to reveal your new PC's backup. Click the back button once to reveal your old PC's backup and once you're happy this is the correct version, click the green restore button to transfer the files to your new PC.



You can also restore data to your new PC from a File History backup made on your old machine.

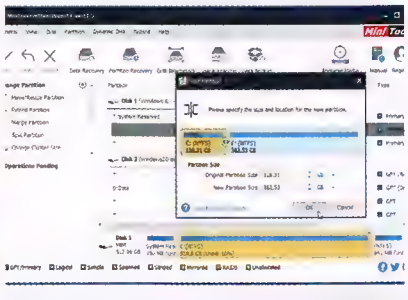
"If you're switching from Windows 7 and have been using Backup and Restore to back up your key files, run it one last time in Windows 7 to bring your backup bang up to date, then copy that backup to an external drive"

HOW TO: Transfer settings with CloneApp



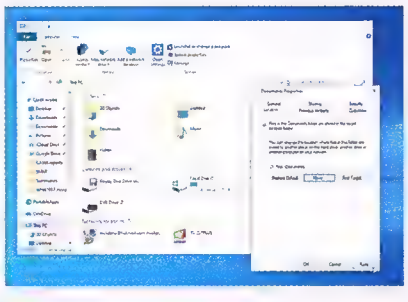
01 PARTITIONING TOOL

If your new PC has a single hard drive that's 256GB or larger, then now is the time (while it's relatively empty) to partition it and separate your data from Windows to protect it against possible data loss. Download and install MiniTool Partition Wizard (**www.partitionwizard.com**).



02 SPLIT A DRIVE IN TWO

Open Partition Wizard, identify your system drive (almost certainly labelled C, and the largest partition on the drive) and click 'Split Partition'. Use the slider to allocate the space you want for your data partition – typically all but 64-128GB. Click OK followed by Apply



03 MOVE USER FOLDERS

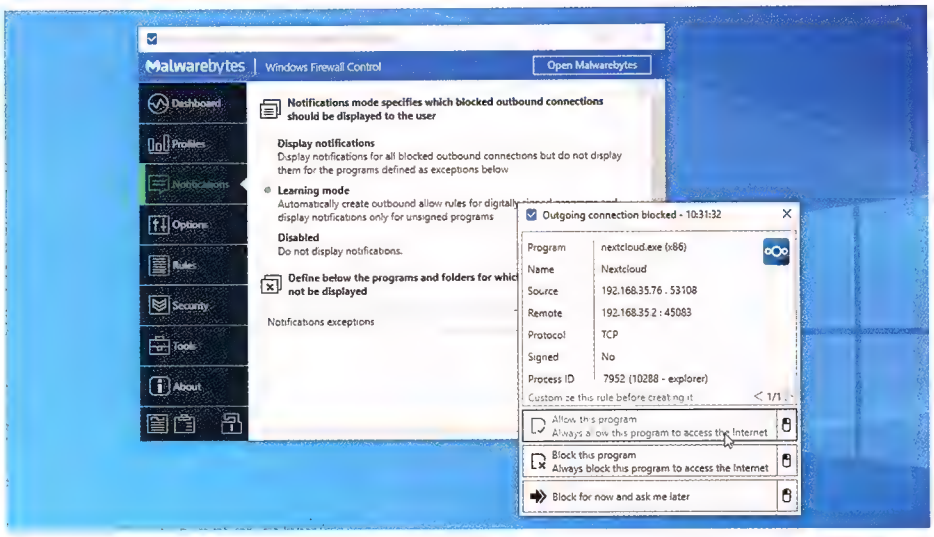
Browse to 'File Explorer > This PC'. Right-click the Documents folder and choose 'Properties > Location'. Click Move, and select a suitable location on your newly formed data drive – such as Username\Documents. Click OK followed by Yes, then repeat for other user folders.

PART 4

Secure your new PC

Before embarking on life with your new PC, take the time to ensure it's as secure as possible.

Your new PC is ready and raring to go: your programs, settings and files have been safely transferred across and your old PC's fate has been decided (the step-by-step guide reveals what to do if you plan to pass it on or dispose of it). But before you take full advantage of that extra speed and power, it's time to make sure your new PC is at least as secure as your old one was. Start by setting up your backups if you haven't yet done so – both File History and the old Windows 7 backup tools are accessible in Windows 10 via Start > Settings > Update & Security > Backup. File History is more flexible – it stores more versions of your files for example – and is likely to be supported for longer than Windows 7 Backup, so choose that if you've not yet made a choice.


Malwarebytes | Windows Firewall Control
Open Malwarebytes
Dashboard
Profiles
Notifications
Options
Rules
Security
Tools
About
Notifications mode specifies which blocked outbound connections should be displayed to the user
Display notifications
Display notifications for all blocked outbound connections but do not display them for the programs defined as exceptions below
Learning mode
Automatically create outbound allow rules for digitally
display notifications only for unsigned programs
Disabled
Do not display notifications.
Define below the programs and folders for whic
not be displayed
Notifications exceptions
Outgoing connection blocked - 10:31:32
Program nextcloud.exe (x86)
Name Nextcloud
Source 192.168.35.76 . 53108
Remote 192.168.35.2 : 45083
Protocol TCP
Signed No
Process ID 7952 (10288 - explorer)
Allow this program
Always allow this program to access the Internet
Block this program
Always block this program to access the Internet
Block for now and ask me later

Give Windows Firewall the ability to block outgoing as well as incoming connections with WFC.

Tighten security

Windows 10 provides strong security by default – the built-in Windows Security is now one of the best tools for detecting and removing threats – but third-party software like Bitdefender offer more pro-active tools to help prevent infections. If you're confident you don't need these additional tools, then at least install the free version of Malwarebytes Anti-Malware (**www.malwarebytes.com**) and be sure to run regular (weekly) scans.

If you stick with Windows' own tools, you might want to strengthen the Windows Firewall by installing Malwarebytes' free Windows Firewall Control (**www.binisoft.org/wfc**), which adds two-way protection to the firewall, allowing you to monitor which programs and processes are trying to connect to the internet, blocking any suspicious ones (like trojans attempting to download more malware).

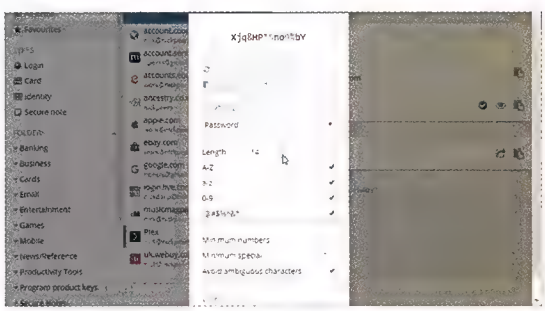
You should also fill any gaps normally covered by third-party tools. Need some form of anti-ransomware protection? Try Acronis Ransomware Protection (**www.acronis.com/en-gb/personal/free-data-protection/**), a free tool with 5GB online storage if you need it for your most sensitive files. Worried out potentially unwanted programs sneaking on to your system? Unchecky (**www.unchecky.com**) provides some extra warnings, and can even untick certain boxes by default to prevent you from inadvertently adding them to your system.

Protect yourself online

Next, make sure you're using a trusted password manager such as Bitwarden (**www.bitwarden.com**) to securely store your passwords, plus help you generate strong random ones. Aim for a minimum of 12 characters, mixing alphanumeric with symbols where possible. If you've not already done so, introduce two-factor authentication to all your major online accounts – including Bitwarden – to protect them in the event of a password breach. When it comes to managing your 2FA codes, Authy (**https://authy.com**) can be used on multiple devices for convenience's sake.

When backing up to the cloud, how safe is your data? Recognising its security isn't perhaps as tight as you might expect, Microsoft has introduced Personal Vault, a place where you can add an extra layer of subscription to particularly sensitive files. Don't trust Microsoft? A tool like Cryptomator (**https://cryptomator.org/**) works in a similar way, with encryption keys stored locally for extra protection. If you lose these, however, it's game over for your data, so keep a separate, unencrypted backup of Crpytomator-encrypted data on a local external drive – just in case.

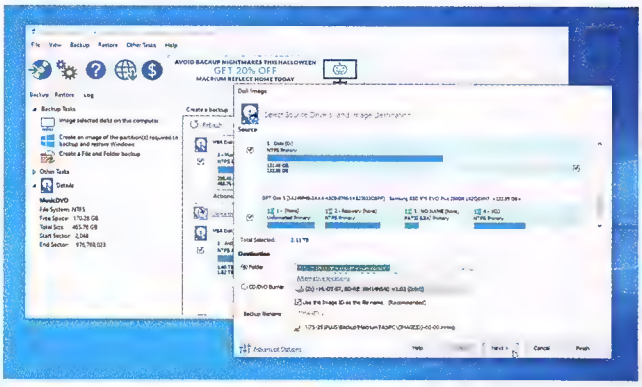
Use your password manager to generate long, randomly generated passwords for extra security.



Worried about who might be snooping on your connection? If you've just switched from desktop to laptop, and plan to log on to Wi-Fi hotspots while out and about, a VPN (Virtual Private Network) service is a must, scrambling your data and ensuring snoopers can't intercept sensitive data. Windscribe (**https://windscribe.com**) is a great free choice.

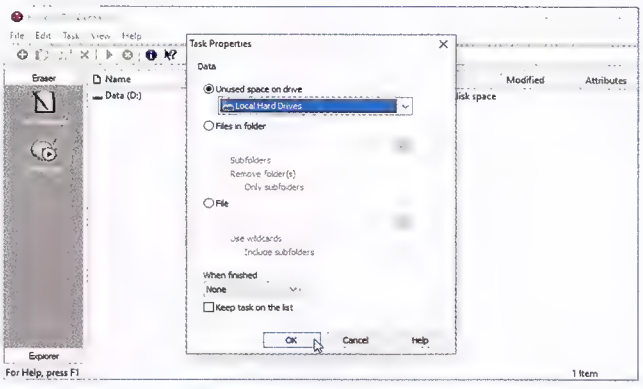
VPNs only protect your data when in transit, so be sure to strengthen your email and browser security independently. If supported, enable DNS over HTTPS within your browser settings (Firefox users will find it under 'Options > General > Network Settings' – click Settings, tick 'Enable DNS over HTTPS' and use the default Cloudflare provider) and install web-safety addons like Norton Web Safe or Bitdefender Traffic Light.

HOW TO: Dispose of your old PC securely



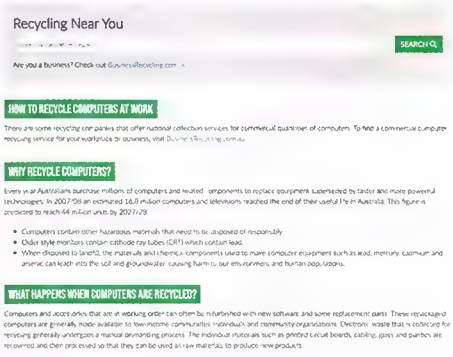
01 TAKE FAIL-SAFE DRIVE IMAGES

Still not taken that fail-safe drive image? Install Macrium Reflect Free on your old PC as previously advised, then take an image of all your old PC's internal drives and partitions to ensure you have future access to files and settings you may otherwise forget to take.



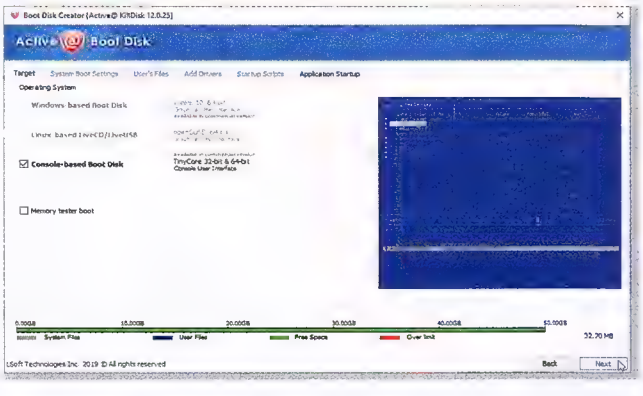
02 RESTORE TO FACTORY CONDITIONS

Consult your PC's support site for instructions on restoring it to factory conditions, having first verified all the apps that required activation to use have been deactivated – not just those you transferred across to your new PC (you never know when you might need them).



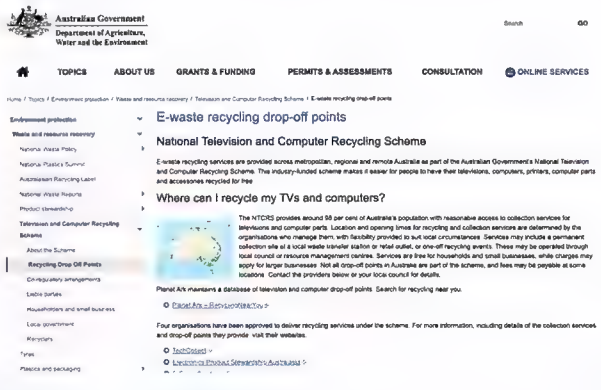
03 SHRED PERSONAL DATA

Launch Eraser Portable (**https://portableapps.com/apps/security/eraser-portable**) and choose File > New Task to set up a task to delete all unused space across all drives. Once created, select the task and press Ctrl-R to run it. Be patient – it'll take hours to completely wipe the drive's free space.



04 SELL OR PASS ON

Check eBay to see if there's a market for recouping some of your costs by selling the PC or individual components such as the RAM and motherboard on. If not, and if your PC is still reasonably modern and fully working, visit **recyclingnearyou.com.au/computers** for a guide to donating it.

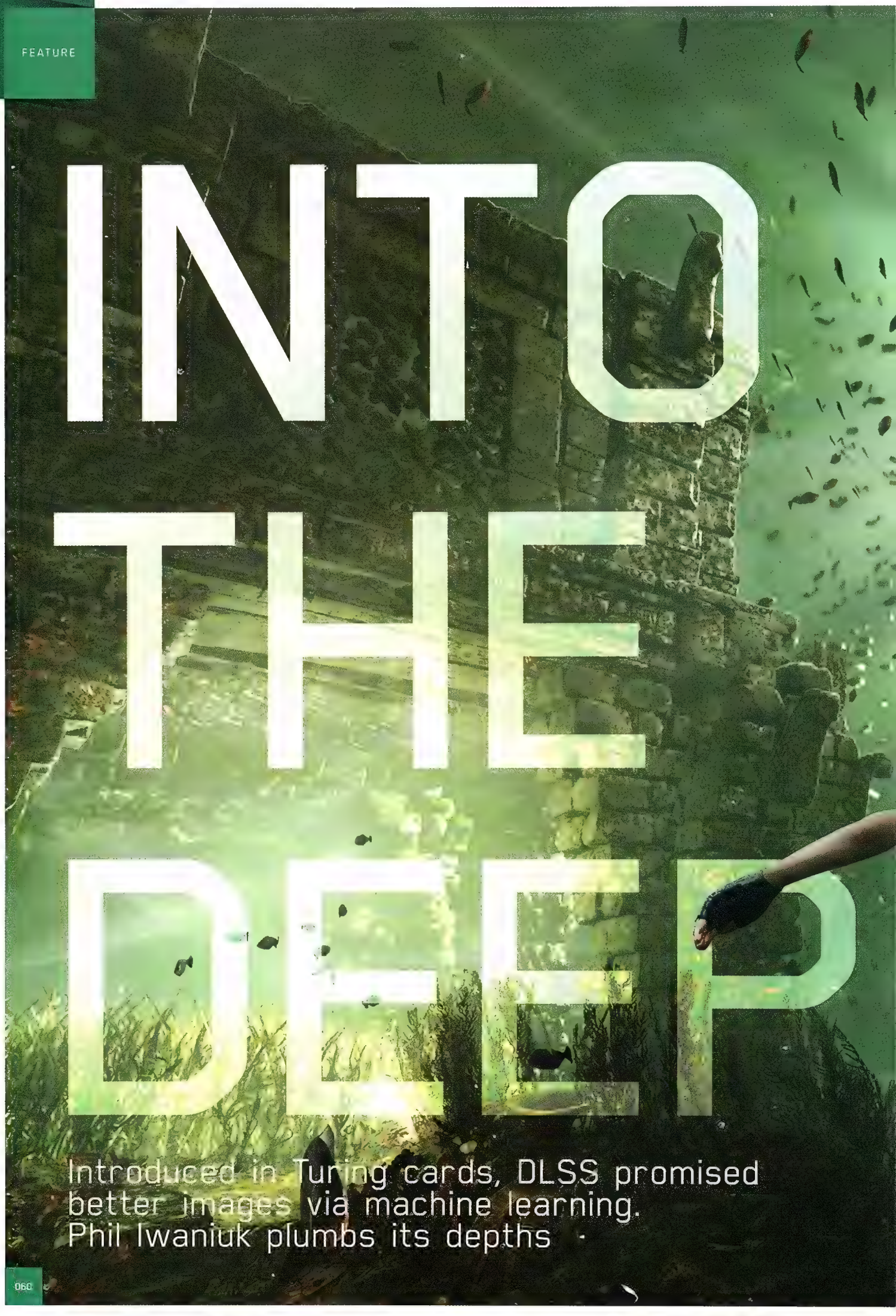


05 WIPE ALL DATA SECURELY

If you decide to dispose of the PC, consider removing any hard drives and placing them in USB enclosures to use with your PC new as external devices. Failing that, wipe any drives securely using a bootable disk like Active@ KillDisk Freeware (**http://killdisk.com/killdisk-freeware.htm**).

06 RECYCLE RESPONSIBLY

If there's nowhere to send your old PC on to, you'll need to dispose of it responsibly. Most local recycling centres will accept old PC equipment in both working and non-working condition – check **environment.gov.au** if you're struggling to find one.



INTO THE DEEP

Introduced in Turing cards, DLSS promised better images via machine learning. Phil Iwaniuk plumbs its depths

"Before we can really assess what deep learning might do for our gaming rigs in five or ten years' time, it's important to pin down what exactly's happening in those Tensor cores"

As sales pitches go, Nvidia's deep learning supersampling (DLSS) is as revelatory, and preposterously sci-fi, as it gets. Specific cores dedicated to machine learning, harnessing bleeding-edge algorithms, take resource-friendly 1440p resolution images and blow them up to super-sharp 4K proportions – and all without the performance hit of actually running at that higher resolution in the first place.

Along with that quietly revolutionary real-time ray tracing capability, DLSS was the big selling point of Turing cards. But while the advantages are real, and available to you in a generous swathe of games, its uneven execution from title to title is confusing. In its worst moments, it's been capable of actually making your game look worse when enabled than in the original native resolution.

But the teething problems might prove trivial when we look at deep learning's potential to turn graphics rendering on its head. Just as real-time ray tracing's proved to be what some might call a soft launch, offering tantalising glimpses of its promise amid the noise of patchy game support and performance issues, so it goes with DLSS. For owners, it feels like being in on the ground floor on an important new advancement, and having to deal with adjustment inertia from software developers and driver writers.

Before we can really assess what deep learning might do for our gaming rigs in five or ten years' time, it's important to pin down what exactly's happening in those Tensor cores, why it differs from temporal antialiasing methods or downsampling, and how it makes the games of 2020 look and perform. And to do that, you have to weigh the marketing talk against the look and feel of games such as *Control* and *Metro Exodus*, frontrunners in DLSS implementation. First, the fundamental premise: What's going on inside Nvidia's Tensor cores?

Remedy's *Control* has some of the best DLSS around. Here it's upscaling a 2560x1600 image...

This much is clear: Nvidia's been working on deep learning for many years now. Current technical director of deep learning, Andrew Edelstein, has been operating in that capacity since 2010, and for years the company's CEO, Jensen Huang, has been demonstrating a deep-learning neural network demo on the trade show circuit in which a computer identified pictures of cats and dogs. The more pictures it examined, the more accurate it became.

Despite its interest and investment in this area for over a decade, it wasn't until 2018 that deep learning was successfully applied to rendering a 3D environment. That breakthrough came via a conditional generative neural network that could interpret video footage of real locations and turn them into 3D environments. VP of applied deep learning Bryan Catanzaro's research team captured dashcam-style video of cars driving around several cities, then identified the "high-level semantics" of each scene – using Unreal Engine 4 to colourise the objects and scenery elements, and teaching the network what a car is, what street lights are, what kerbs look like. Once that was established, the network could correctly identify them independently in future video footage, just like the AI that picked out cats and dogs.

Control's real-time ray tracing makes it an especially demanding title, even for RTX cards.

The end result isn't a simplistic environment, either. The busy downtown streets are packed with recognisable cars, each one a different real-world model, just as you'd see if you were unfortunate enough to find yourself in a real traffic jam. Beyond them are trees and skyscrapers, and it's possible to drive through the environment as if it were just another urban circuit in a racing game (naturally, the authors of this tech were quick to put it to other tasks. One fed the learning AI footage of people dancing *Gangnam Style* to render a 3D scene of their colleague doing a very convincing rendition). It's undeniably impressive to see such a vivid 3D environment rendered intelligently by a machine that only had flat video data to build it from – but it bears repeating that this only happened in 2018. This is still very new technology.

The big picture

The roll-out of current-gen RTX Turing cards took things a step further with DLSS. The big picture involves, appropriately, a lot of really big pictures. Specifically, it involves showing thousands of screenshots of a supported game to a neural network like those described above. In this case, the screenshots act in the capacity of the drive-along video footage, or the cats and dogs, but they're supersampled 64 times bigger than the original image. That's 64x SS. Anyone feeling smug about running *Red Dead*

...and here it's running that resolution natively. The visual difference is very subtle, but accounts for a 15fps change.

Redemption with 8xMSAA, sit back down.

Another version of those same images, without any antialiasing, is also fed to the neural network, and it's then programmed to contrast and compare them like a superintelligent high schooler sitting their English exam. In this case, instead of learning how to hold down a job at Target and shake down its parents for cash when things get tight, it's learning how to approximate the x64 SS image without the massive computational hit of doing that process verbatim. This preliminary work all happens long before you load up the game, which like the relative novelty of the tech, is worth bearing in mind later on as we examine its implementation so far.

As the learning AI repeats this process, over and over, it gets better at it, modifying its algorithms until it automates the process and reaches a visual result that looks like a 64x supersampled image, without any blurring, ghosting, or glitched-out transparency effects. The fruits of all that labor are then taken from the supercomputer, written on to Nvidia's game-ready drivers, and handed to your RTX graphics card. That saves your system from the computational tasks of an actual deep-learning supercomputer: handy. With the knowledge of precisely how to approximate supersampled images of your game now available, the card's Tensor cores interpret it, and put it into action in a way that traditional GPU architecture couldn't. Theoretically, that means if your desired final image quality is 4K, you can drop down the rendering resolution to 1440p, and enjoy the reduced performance cost that comes with it, then ask DLSS to enlarge the image back to 4K.

Teething problems

Perhaps the most important thing to note about that whole process is the very first step: feeding the supercomputer

The Alternatives

JUST AS THERE'S MORE THAN ONE WAY TO PART A FELINE FROM ITS OUTER WRAPPER, RENDERING AN IMAGE TO GIVE THE APPEARANCE OF A HIGHER RESOLUTION THAN IT'S RUNNING AT HAS A FEW METHODS.

One of them is checkerboard rendering, often found in 4K versions of console games. This involves rendering half the scene, then (in simplified terms) filling the other half using the last frame's data. The performance gains against rendering the arenderer is essentially given half the task within the same time frame versus producing a full higher resolution image. This allows systems whose hardware couldn't output 4K images at a playable frame rate to "cheat" by checkerboarding.

Then there's supersampling antialiasing, which despite its high computational cost, is as old as the hills – load up your favorite games from the noughties, and you may well see an SSAA option somewhere in the graphics menu. Here's how it works: An image that's bigger than your native resolution is rendered, then the renderer takes an average of several pixels' color values, and applies that to one pixel in the final frame, giving the impression of a much higher-resolution image. It's not a million miles away from DLSS, but minus the aid of deep learning.

You've likely heard of or even employed "downsampling" to achieve higher resolutions than your monitor's native output, too, and essentially this is just another form of SSAA. Ordered grid supersampling antialiasing, to be precise. The distinction here comes down to the pattern used when sampling pixels to take an average and shrink the larger-resolution render back down to your monitor's native resolution. In this case, ordered grid SSAA examines the entire object, not just the edges, which are prone to visible jaggies, and this creates a higher fidelity final image than other antialiasing methods.

Metro Exodus. Whisper its name in the company of graphics cards and you'll hear a gasp of fear.

images of a game so that it can recognise the jaggies and devise a "perfect" next frame. If the associated game-ready driver is to be released in tandem with the game, this requires access to the final code ahead of time, plus however long it takes the supercomputer to refine and automate this process, then for the driver team to harvest the data and bake it into the driver files. Nvidia hasn't publicly detailed how long any of these processes take. It might be weeks from launch, or it might be months. Either way, this was never going to be a fire-and-forget graphics option that worked perfectly in the first supported game you tried an RTX card on.

There are three big variables at play in any game and its associated DLSS effectiveness. The first is the game engine itself. Although Unreal Engine is increasingly ubiquitous on the gaming landscape in 2020, there are plenty of exceptions. *Doom Eternal* continues the proud tradition of bespoke id game engines with id Tech 7. Unity still has a presence, particularly amongst 3D indies. Cryengine V has several high-profile games on its roster, including *Hunt Showdown*, and Amazon Lumberyard will surely get its coming of age moment with a big release soon (nobody's counting *The Grand Tour Game*). Every game engine has to be interpreted slightly differently by Nvidia's deep-learning supercomputer, and the absence of a one-size-fits-all solution introduces complexity, increases the likelihood of errors, however tiny, and increases variance in results.

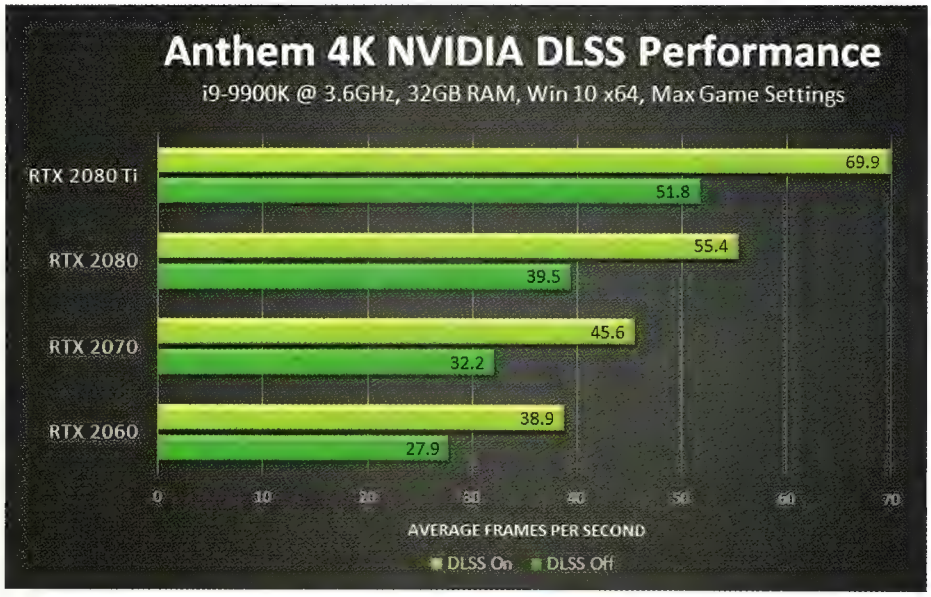
The next variable is obvious enough: complexity of content, to use Nvidia's own terminology. It's harder to approximate a supersampled frame from *Metro Exodus* than in *Quake II*. There are more surfaces, more transparency and lighting effects to figure out and disregard as aliased lines. And while that's a pretty academic comparison, considering the general fidelity level of PC releases in 2020, it illustrates a point. Games with more densely populated scenes are going to need more help from DLSS to achieve the desired final image. Genre plays a bit part in variance here, too – compare a racing game like *Assetto Corsa Competizione*, where you're either looking at a whole lot of cockpit or your own car's exterior, then opponents' vehicles and comparatively sparse track environments, to an atmospheric action game such as *Control*, whose every room is bustling with incidental objects, architectural flairs, and high-poly characters.

The third is perhaps the most significant: the time spent training the supercomputer itself to produce the data that your Tensor cores can use in the driver. As with all machine learning, and indeed all the learning we undertake with our own brilliantly fallible human brains, repetition is key, and the more time Nvidia's supercomputer has to analyse images, the better the results. The proof personified of this facet is in the dramatic improvement of DLSS implementation in games such as *Metro Exodus* from launch day to present. Had you checked the DLSS box back in February 2019, you would have been met by a very blurry image, dramatically lower fidelity than the equivalent native resolution image, then you would have probably unchecked the box, and mentally thrown DLSS on to the same trash pile as 3D monitors, that ET game, and Google Plus, never to think about it again. It's understandable. Complete that same process today, and you see an unrecognisable result: very convincing supersampling, with few noticeable artefacts, and a minuscule performance cost versus running at that larger resolution.

User control

Perhaps another reason gamers haven't fully embraced DLSS is its narrow range of control. Most games offer a very limited number of render and final resolutions, and in some cases, such as *Anthem* or *Shadow of the Tomb Raider*, exist

The performance benefits of DLSS are clear, but can you live with the potential fidelity hit?



only as a checkbox in which the game developers or driver writers decided upon an internal resolution that DLSS would start from and build up a bigger image around. Those parameters varied between RTX GPU models, too, so your internal resolution of the same game on an RTX 2070 and 2080 Ti might be totally different. That's confounding for the consumer, and it undersells the power of the technique. But it worked this way at launch for several titles to actually preserve performance.

If your GPU isn't being taxed much in the first place, increasing the resolution the old-fashioned way results in a faster frame render time than utilising the Tensor core. DLSS is designed to lighten to load when the GPU really has its back to the wall, and the Tensor cores require a fixed amount of time to run their neural network algorithms, so if you're already enjoying high frame rates, DLSS won't help. That fixed proportion of each frame render time might actually hurt performance if it's well above 60fps – although, again, Nvidia hasn't specified exactly how long Tensor core DLSS operations take, so we can't pin down a tipping point in FPS when it becomes redundant.

Metro Exodus produced a horrible blurring effect with DLSS at launch, but after several patches, it's now much better.

None of this is easy to convey succinctly in a graphics options menu, so the decision was made to restrict the internal resolution, and prevent gamers from hamstringing themselves inadvertently by enabling DLSS in situations they didn't need it in. As the technique and game support have matured, we're seeing some of the control options expand.

Control, aptly enough, proves a fine example. Check the DLSS box to enable the technique, and you'll find "Resolution" and "Render resolution" parameters. This allows you to decide on both the smaller internal render resolution, and the upscaled end result, and in addition to the refinement of DLSS's end result, borne of many thousands more images being fed to the deep-learning supercomputer since launch, this makes it easier to understand what it's doing. In *Control*, it's also possible to edit the config.ini file and manually set your render resolution anywhere between the final resolution and one quarter of it. Despite the risk of a performance hit, you can even manually set DLSS to upscale just slightly from your internal resolution, so it functions more like temporal AA; the image quality might be better, but it's unlikely to perform that process faster than the game's TAA option itself.

Skynet and beyond

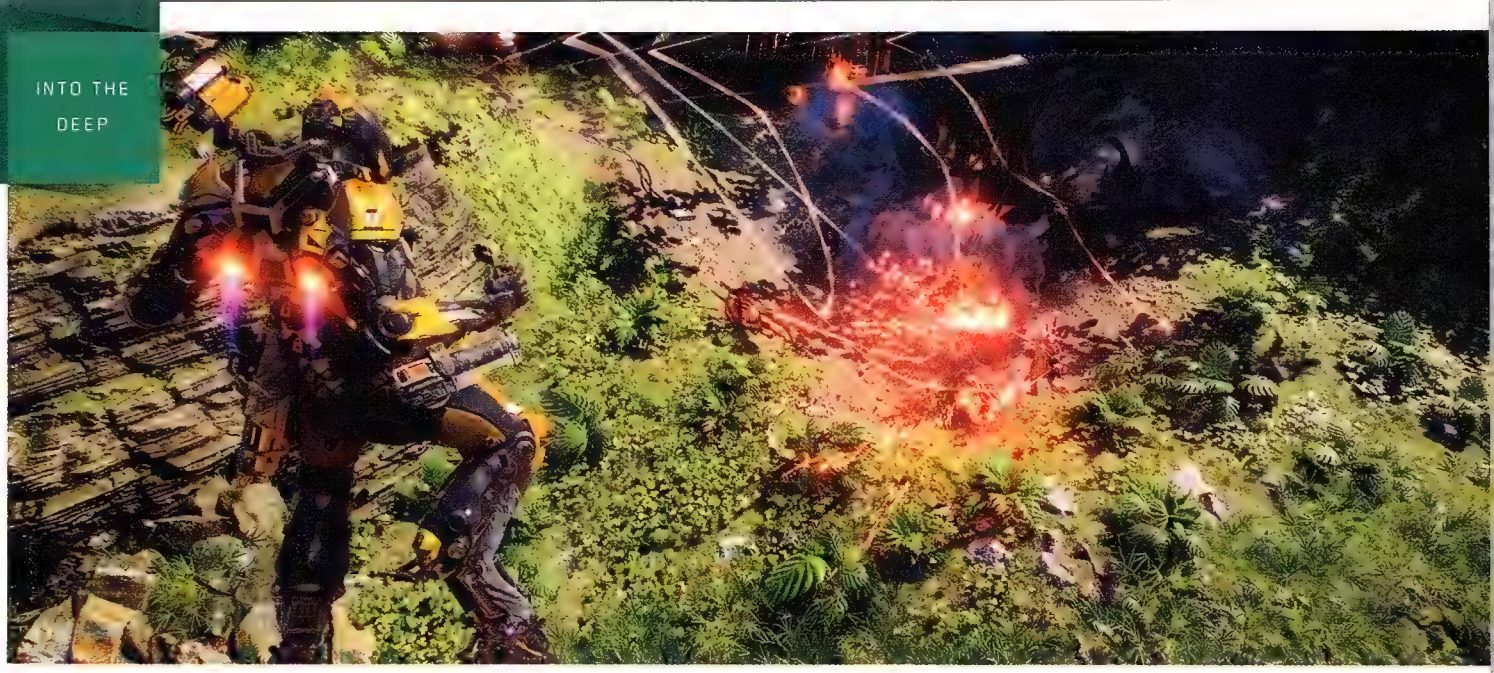
It's clear that using DLSS to target a 4K image isn't the same as running a game at 4K in the first

The Supported Games

AS ACADEMICALLY INTERESTING AS IT MIGHT BE, DLSS DOESN'T COUNT FOR MUCH UNLESS THE GAMES YOU PLAY ACTUALLY SUPPORT IT.

There may not have been a raft of essential titles ready to push your RTX card's new features to its limits at launch, but now, at least, there's a total of 30 current or upcoming DLSS-supported games. Some examples, such as *Final Fantasy XV Windows Edition*, have added the support post-release, while others, such as *Metro Exodus*, shipped with a version of DLSS that seemed to degrade the overall image sharpness, but thanks to later refinements and patches, works very differently, producing a sharper image with DLSS enabled – just as intended. Then there are forthcoming releases such as *Bloodlines 2*, which have had the benefit of seeing other games' implementation of DLSS, and the ability to learn from them.

- *Anthem*
- *Ark: Survival Evolved*
- *Atomic Heart*
- *Battlefield V*
- *Darksiders III*
- *Dauntless*
- *Deliver Us The Moon: Fortuna*
- *Fear the Wolves*
- *Final Fantasy 15*
- *The Forge Arena*
- *Fractured Lands*
- *Hellblade: Senua's Sacrifice*
- *Hitman 2*
- *Islands of Nyne*
- *Justice*
- *JX3*
- *KINETIK*
- *Mechwarrior 5: Mercenaries*
- *Metro Exodus*
- *Monster Hunter World*
- *Outpost Zero*
- *Overkill's The Walking Dead*
- *PlayerUnknown's Battlegrounds*
- *Remnant: From the Ashes*
- *SCUM*
- *Serious Sam 4: Planet Badass*
- *Shadow of the Tomb Raider*
- *Stormdivers*
- *Vampire: The Masquerade – Bloodlines 2*
- *We Happy Few*



place. Even after plenty of post-release support on *Control*, *Metro Exodus*, and others, the difference is clear. But DLSS shouldn't be characterised as a failure, not least because of the ways it might be better used in the future.

One of those pertains to ray tracing, the other Turing headline act. Anyone brave enough to have enabled it in-game knows the associated performance cost, and that cost grows in direct relation to resolution.

EA's *Anthem* was another flag-waver for DLSS, but it produced an overly glossy effect.

If we can use DLSS as a smart upscaling tool, ray tracing doesn't have to be a PC-melter, but a technique available to the masses. That makes it more attractive to game developers for broader implementation, and as that knowledge base grows for how to implement it, the ray tracing we see in-game improves. It's a perfect and evolving win-win.

Virtual reality might prove to be DLSS's real redemption moment, though. Simply because our eyes work in a way that focuses on a central point, we don't actually need to see the entirety of an image in high resolution. You could lower the resolution of the area covered in our peripheral vision, and our eyes wouldn't notice, because our peripheral vision is a kind of "low-res" sight in the first place. VR headsets, where our eyes are incredibly close to the screen, is the ideal guinea pig for adaptive resolution based on our focus point, and DLSS might yet prove to be the breakthrough.

A brief history of machine learning

HOWEVER ADVANCED ARTIFICIAL INTELLIGENCE MIGHT BE, ULTIMATELY IT'S STILL BASED AROUND THE WORKINGS OF OUR OWN BRAINS.

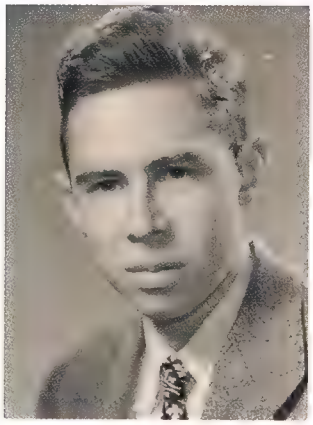
Machine learning's no different – initially devised based on a model of brain cell interaction in Donald Hebb's 1949 book The Organization of Behavior, the earliest model focussed on our own neurons' changes in properties when repeatedly activated together, creating pathways, and extrapolated an artificial system built around those same behaviors. Light bedtime reading it certainly is not.

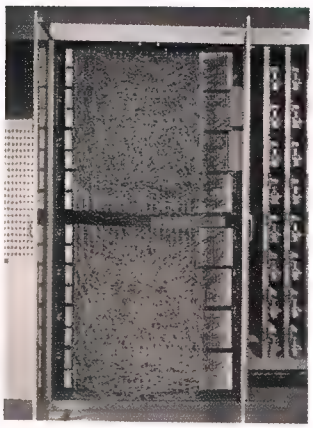
IBM's Arthur Samuel started work on a computer program designed to play checkers shortly after, in the early 1950s. With very little to work with in the way of computer memory, Samuel had to design a degree of independence into the program, assigning scores to each position on the board and their chances of scoring points. This program also remembered all the positions it had previously been on. It's believed that Samuel also coined the phrase "machine learning."

Cornell Aeronautical Laboratory's Frank Rosenblatt combined these two ideas in 1957 in a machine that went by the name Perceptron, beautifully typical of its era. Perceptron enjoys the accolade of being the world's first successful neuro-computer; however, it failed in its intended purpose of pattern recognition in images, such as faces. Research and enthusiasm for machine learning faded thereafter.

However, the "nearest neighbor" algorithm paved the way for basic pattern recognition in 1967, and while artificial intelligence continued on a trajectory of knowledge-based programming, machine learning research bubbled away in the background with the new directive to solve practical problems, rather than simply training AI.

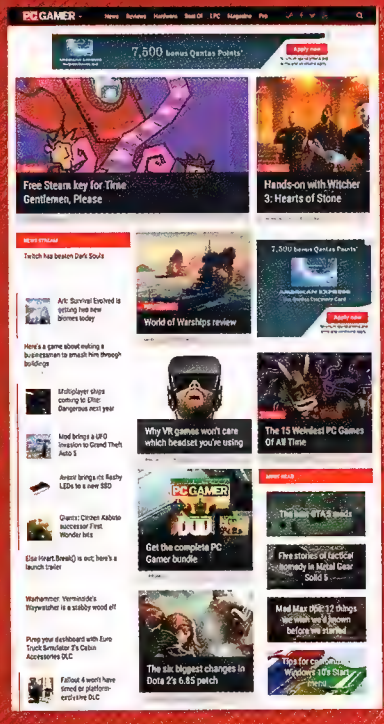
Three major breakthroughs in the '90s and '00s teed up our current age of advanced machine learning – firstly "boosting" algorithms in 1990, which minimised bias during supervised learning, then speech and facial recognition, driven by the mobile communications tech boom. Now we reach its apex: making our games run better. ■





From left to right: IBM's Arthur Samuel; Cornell Aeronautical Laboratory's Frank Rosenblatt; the Perceptron supercomputer, pictured here looking like two open drawers of vermicelli.

SMARTER COOKIES ENABLED


PC GAMER
7,500 bonus Qantas Points*
Apply now
Free Steam key for Time Gentlemen, Please
Hands-on with Witcher 3: Hearts of Stone
World of Warships review
Why VR games won't care which headset you're using
The 15 Weirdest PC Games Of All Time
Get the complete PC Gamer bundle
Fire stories of tactical comedy in Metal Gear Solid 5
The six biggest changes in Dota 2's 6.85 patch

JOIN US ONLINE AT
WWW.PCGAMER.COM

10 free apps you can't live without

Everybody – and we mean everybody – needs this collection of free tools and apps, curated by Nick Peers

Whenever we reinstall Windows, there's always a collection of apps that we install as a matter of urgency. These programs are essential for a variety of reasons, and we'd like to share them with you in case any have slipped through the gaps in your PC knowledge.

The ten applications we've chosen for this roundup are all free to install and use – some may have additional features locked behind a one-time purchase, but their core functionality (and the sole reason they're in this list) is completely free to use.

Turn the page and you'll find our recommendations for such diverse activities as browsing the web, editing office-based files, editing video and listening to music. There are also tools for backing up, increasing your PC's security, editing text files and improving your photos. Throw in the ultimate media player and free data recovery tool and your list is complete.

Or is it? For every single application we suggest, we've thrown in a bonus program. In some cases, these are simple alternatives to our main recommendation, to give you more choice in case our main suggestion doesn't float your boat. But in others, they're companion apps that you should install alongside your main application for additional functionality.

Ready to discover the apps you've been missing all your (computing) life? Turn the page to get started.

PAGE 070
Browse the web

PAGE 071
Edit images like a pro

PAGE 072
Play any media on your PC

PAGE 073
Foolproof backups

PAGE 073
Get extra security

PAGE 074
Get a free office suite

PAGE 075
The ultimate free data recovery tool

PAGE 076
Edit videos for free

PAGE 077
Boost your PC's music player

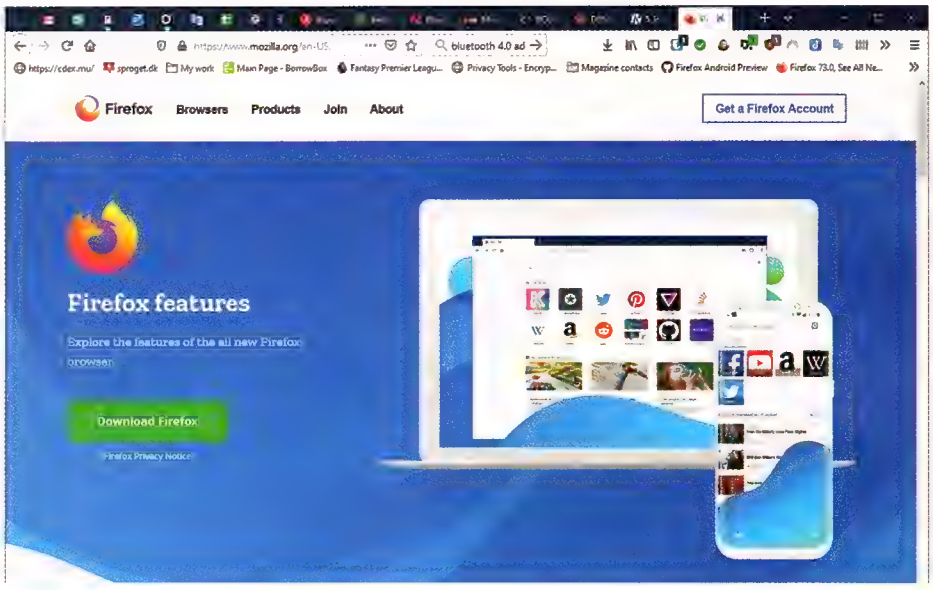
Browse the web

MOZILLA FIREFOX: Choose this open-source web browser for speed and security.

These days, Google Chrome reigns supreme as the desktop browser used by most, so why do we prefer to use Firefox? The pure and simple reason is choice: Mozilla Firefox is one of the few browsers left that uses its own browser engine (Gecko) to render web pages. Other rivals – Opera, Vivaldi and even Microsoft Edge – all make use of Google's Chromium engine. Following a single standard is all well and good, but lack of competition inhibits innovation, which is why we say stick your colours to the Mozilla mast.

It helps, of course, that Firefox is a capable browser in its own right – its rapid-release cycle means it's constantly evolving (although if it changes too rapidly for your tastes, install Firefox ESR – Extended Support Release – instead from **www.mozilla.org/en-US/firefox/enterprise/**). Pair it with a Firefox account and you can sync your bookmarks, history, open tabs and other settings between computers and even Firefox on your mobile.

In 2018, Firefox relaunched itself as Firefox Quantum, and with the new name came a speed boost: performance is now on a par with Chrome, removing another barrier to switching.



Strike one for the little guy by switching your browser to the fast, powerful and secure Firefox.

More security and privacy

Firefox's open-source nature means all development and changes are transparent, and it deliberately limits the amount of data it collects while pioneering tools and features to increase your privacy – recent releases have ramped up built-in protection against trackers, cookies, fingerprinters and so-called cryptominers while giving you greater control over what permissions you grant to websites.

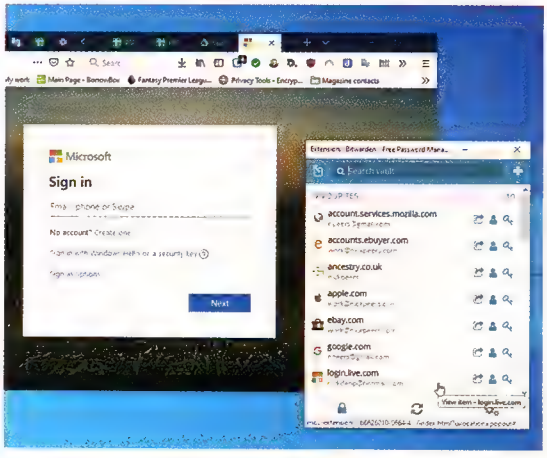
We also recommend enabling DNS over HTTPS – another Firefox-pioneered feature. This increases browsing security by encrypting the resolution of web addresses. The feature is hidden away – open Options > General, then scroll down and click Settings under Network Settings. Tick Enable DNS over HTTPS and leave the default Cloudflare provider selected before clicking OK.

ALSO CONSIDER: If Firefox doesn't float your boat, then now's a good time to give Microsoft's Edge another look – it's been completely rewritten using the Chromium browser engine. Download your copy from **www.microsoft.com/edge** now – remember, you can run multiple browsers side-by-side, so why not use it as your fallback for those few websites not optimised for Firefox?

Five essential browser add-ons

Whichever web browser you choose, consider the following three add-ons essential. First, Bitwarden (**www.bitwarden.com**) is our go-to password manager, ensuring all your online accounts are protected by strong, unguessable passwords - the browser add-on makes it easy to autofill logins and forms. Next, filter out potentially dangerous ads, trackers and malware sites with the help of uBlock Origin (**https://github.com/gorhill/uBlock**) – don't forget to whitelist trusted websites. HTTPS Everywhere (**www.eff.org/https-everywhere**) ensures you always get a secure connection to any website that supports it and doesn't automatically redirect you.

Firefox users should check out two further add-ons courtesy of Mozilla: first, Facebook Container (**https://addons.mozilla.org**) blocks all Facebook trackers on third-party websites to prevent it from spying on your online activity. And secondly, Facebook Multi-Account Containers lets you create isolated 'identities' within Firefox. Each identity is se parate from the others, which makes it possible to log into a website with two or more different accounts without having to log out of the others first. It's the perfect way to keep personal and work browsing separate.



Bitwarden makes it easy to manage online passwords in your web browser.

Edit images like a pro

PAINT.NET: Get advanced image-editing tools for zero cost thanks to this free app.

Everyone needs to edit images at some point in their lives, and while Windows ships with the Photos tool, it's more of an organiser than an editor. At the other end of the scale are expensive tools such as Photoshop that come with complexity on top of the asking price. For most people, though, something in the middle is what's required, and Paint.NET is that tool.

It's relatively straightforward to use – load an image, and you'll find all the basic tools you need to crop, rotate, resize it and so on. There is a variety of selection tools for working on part of the image – including the magic wand and magnetic lasso for irregular objects. You'll also find various correction tools, from brushes and erasers to a clone stamp tool for eradicating dust, scratches and other unwanted elements from scanned vintage photos.

The Effects tab provides access to a variety of different filters for further editing – these range from special effects like applying art-like effects (such as oil painting or pencil sketch) to performing further corrections using the Blur and Photo categories.

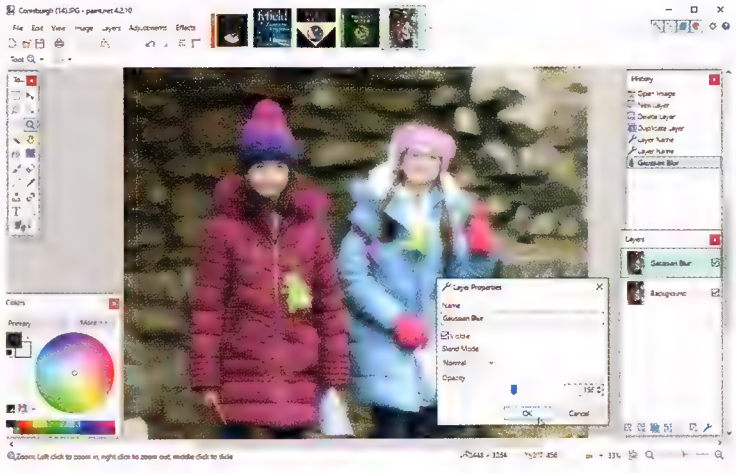
Like Photoshop, Paint.NET supports layers – this allows you to apply non-destructive effects to your image by duplicating the original image and performing your edits to the second layer. The Adjustments menu also provides numerous ways of improving an image's lighting – focus on the Curves and Levels tools for professional-level editing. You can also apply colour filters to your image from here – including Sepia and Posterize.

Free powerups

Can't find the tool or effect you're looking for? Paint.NET supports plugins, allowing you to expand the program's functionality further. The step-by-step guide reveals how to incorporate them into the program. Plugins we recommend include Shadow/Highlight Recovery and Sharpen+ (an improved version of the default tool) for correcting photos.

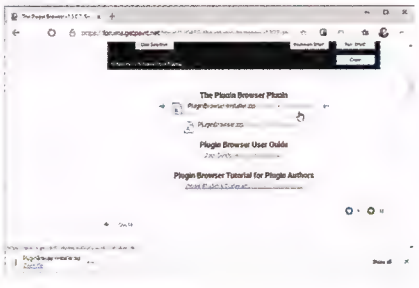
Paint.NET supports a wide variety of file types, but any missing ones – such as Photoshop's native PSD format (which supports layers) – can be added via the plug-in browser.

ALSO CONSIDER: Need to rename, convert or edit multiple files? Save time by performing batch operations on them using the brilliant Faststone Photo Resizer (**www.faststone.org**).



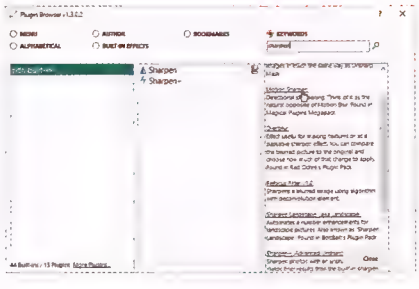
Paint.NET is packed with tools to help you edit and transform your photos.

HOW TO: Add extra functionality to Paint.NET



01 INSTALL BROWSER

Visit **https://forums.getpaint.net** and navigate to 'Plugins – Publishing ONLY'. Open the pinned 'The Plugin Browser' thread and download PluginBrowser-Installer.zip to your downloads folder. Close Paint.NET, then extract and run PluginBrowser-Installer.exe.



02 LOCATE NEW PLUGINS

After installation, open Paint.NET and choose 'Effects > Plugin Browser' to view currently installed plugins. You'll also see a keyword search tool: this can be used to search the plug-in index online to track down more plugins – just click a hyperlink to be taken to the relevant page.

03 INSTALL NEW PLUGIN

Plugins are downloaded as zip files; if no installer is provided, simply extract the .dll file inside the zip archive to the relevant subfolder inside C:\Program Files\Paint.NET – this is typically Effects or FileTypes (note that you'll need administrator access to do so).

Play any media on your PC

VLC MEDIA PLAYER: Watch any video – including DVDs – on your PC for free.

Video comes in all shapes and sizes these days, and VLC Media Player (**www.videolan.org/vlc**) is the player that can handle it all, whether you're watching digital video files, streaming over the internet or wanting to enjoy a good old-fashioned DVD through your PC. The program has been designed to handle just about any format you can throw at it – which makes it the only video player you need.

You can open a wide variety of files directly from the Media menu – choose Disc and you'll see options for both DVD and Blu-ray. Note, however, that encrypted Blu-rays aren't supported (we recommend LEAWO Blu-ray Player for watching Blu-rays on your PC – see **www.leawo.org/blu-ray-player/**). No such problem with DVDs though – you can browse menus and point and click. One tip: choose 'Video > Deinterlace > Automatic' to improve the quality of DVDs (particularly older TV shows).

Once you've opened your media, use the controls beneath the main display to control playback – an extended button reveals audio and video effects, plus a handy Synchronisation tab for correcting lip-sync problems caused by mismatched audio and video streams.

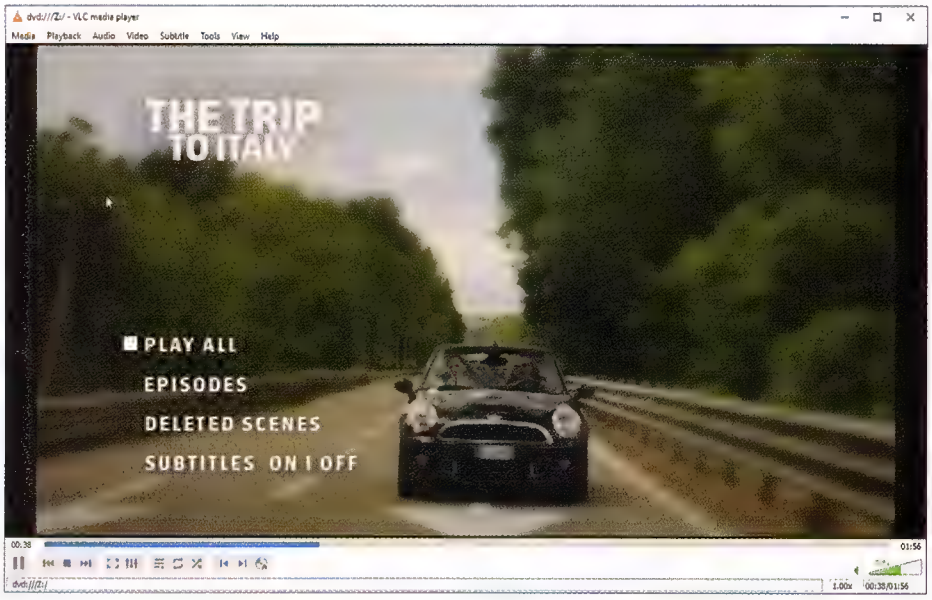
Turn your digital cache of photos into a striking photo book to view or share with others.

Watch TV on VLC

There are lots of advanced uses for VLC too – you can link to a USB TV tuner connected to your PC, for example. Select Media > Capture Device, then choose TV – digital under Capture mode, select DVB-T for Delivery system and enter the frequency of the mux (multiplex) containing your target TV channel in the appropriate box.

Click Play, and after a short pause you should hear a radio channel or see a TV channel. Open the Playback > Programme menu and you'll have a list of all available channels on that mux. For more advanced uses, check out the step-by-step guide.

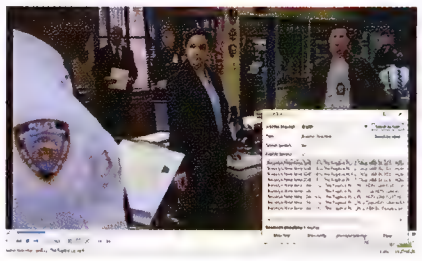
ALSO CONSIDER: If you're looking for something to turn your PC into an entertainment centre, complete with media management tools (plus support for both CD and DVD playback), then install Kodi (**www.kodi.tv**). It's perfect for large screen displays and can play pretty much anything VLC can.



TOP TIPS: Advanced VLC tips and tricks

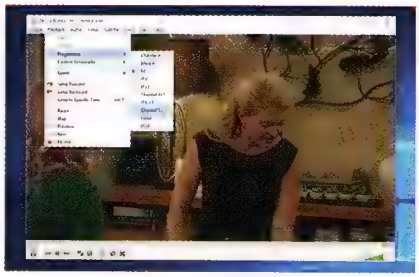
01 CHROMECAST

Open the Playback > Renderer menu, and if your Chromecast device hasn't already been detected (in which case simply select it), click Scan to search for it on your local network. Then start playback in VLC – its screen will remain blank, and the video will appear through Chromecast.



02 WATCH WITH SUBTITLES

If you're watching a DVD, or your video file has embedded subtitles, switch them on via the Subtitle → Sub Track menu. You can also download subtitles directly into VLC via the View → VLsub menu – just enter your search terms if needed, then click 'Download selection' next to a match.



03 BUILD A TV PLAYLIST

Selecting TV channels by frequency isn't elegant: stop playback and return to the playlist where you can configure each mux as its own playlist entry. Once done, choose Media > Save Playlist to File and to save your stored channels as a playlist, easily accessible via the Media > Open File option.

Foolproof backups

MACRIUM REFLECT FREE: Take a failsafe backup of your entire hard drive for added peace of mind.

Put the right backup plan in place, and you need never worry about accidental data loss, system crashes or botched Windows Updates again. Windows' own File History provides limited protection for key folders and files, but the only foolproof backup is a drive image – an exact copy of an entire hard drive or partition.

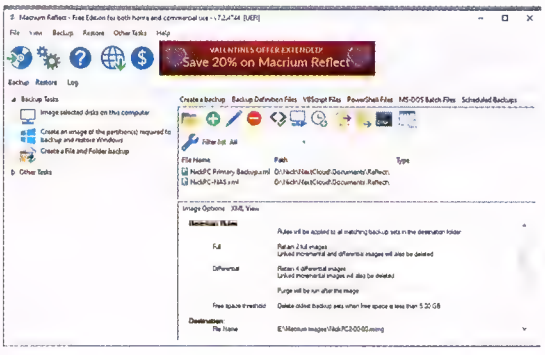
The best tool for the job is Macrium Reflect Free (**www.macrium.com/reflectfree.aspx**). Select the drive(s) or partition(s) to back up – choose Create an image of the partition(s) required to backup and restore Windows to protect your system – and then once you've chosen your backup destination, create a schedule that mixes full and differential backups (the Differential Backup Set is a good template if you're pushed for time). Make sure you click Advanced Options to tick Verify image under Auto Verify Image and you're good to go.

Good backup practice

We recommend (as with all backups) alternating your backup between two different destinations – say a USB drive attached to your PC and a network drive set up in another room. Also be sure to create the rescue media when prompted – in the event of a crash, booting from this makes it easy to roll back to your latest backup and restore your PC.

ALSO CONSIDER: At least one backup should be stored remotely, and the cloud is the obvious destination. But do you trust your cloud provider with your data? Install Duplicati (**www.duplicati.com**) and you can create backups to store with any cloud provider that come with an extra layer of encryption to make them practically impregnable, even if your online account is compromised.

"We recommend alternating your backup between two destinations"



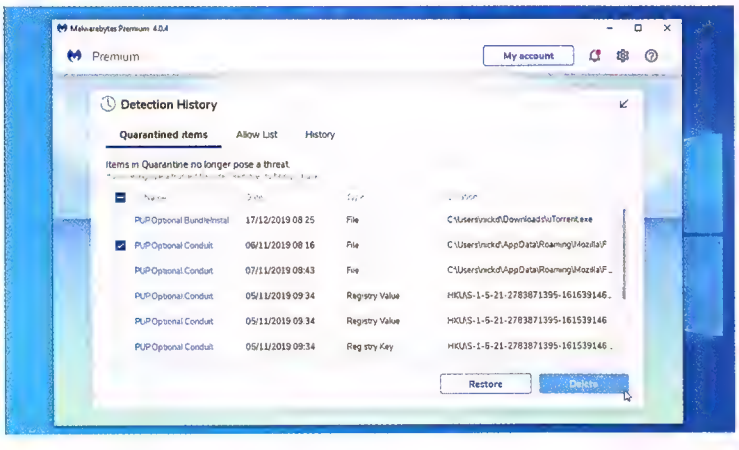
Set up a schedule that mixes full and differential backups for maximum protection.

Get extra security

MALWAREBYTES ANTI-MALWARE: Add another layer of protection to your PC.

These days, even the built-in protection offered by Windows is pretty robust, but you can never be too safe. Whether you rely on Windows Security or go for more fully featured protection from the likes of Bitdefender, Avast! or Norton, you need Malwarebytes Anti-Malware (**www.malwarebytes.com**). The free version of the program allows you to periodically scan your PC for nasty intruders missed by your main package – MBAM excels in detecting potentially unwanted programs that fall into the grey area between safe, but annoying and outright dangerous.

It's simple to install and run – just get in the habit of launching it weekly to scan for potential threats. The Premium version ($39.99 a year) offers realtime protection to block threats before they get on to your PC – you can run this alongside your existing security tool.



Bitwarden makes it easy to manage online passwords in your web browser.

Examine results closely

MBAM places suspicious items in quarantine – you can review them after a scan, or place them in quarantine and review later via Detection History. You'll see many are listed as 'PUP.Optional' – click the name to view a description of the threat online. You may even decide Malwarebytes is being overzealous, and you can restore them from here.

ALSO CONSIDER: If you're relying on the built-in Windows Firewall for protection, note it's only configured to monitor incoming traffic. Add protection for outbound traffic too by installing Windows Firewall Control (**www.binisoft.org/wfc.php**). This allows you to monitor – and block if necessary – all attempts to access the internet from programs and processes installed on your PC.

Get a free office suite

LIBREOFFICE: Make the switch from a Microsoft Office subscription to zero cost (or ads).

Gone are the days when the only alternatives to Microsoft Office cost money, with no easy way to move files between platforms. Free office suites are ten-a-penny now, but many are limited to just the core three apps – word processor, spreadsheet and presentations tool – and are ad-supported. None of these restrictions apply to LibreOffice (**www.libreoffice.org**), however.

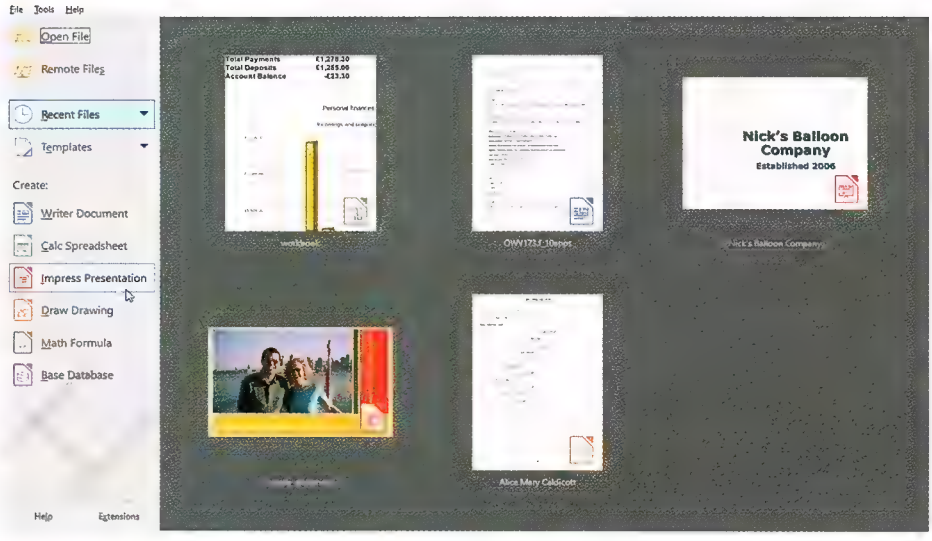
Not only is LibreOffice ad-free, it offers replacements for Access (Base) and Visio (Draw) to provide database and drawing/flowchart functionality in addition to Writer, Calc and Impress, plus bonus tools in the form of Math (a formula editor) and Charts, a tool for producing pie charts and the like.

Getting started

LibreOffice's components can be opened independently, or through a centralised launcher. This provides convenient access to each application as well as recently opened documents. Each application opens with the classic interface familiar to anyone who used Word 2003 or earlier – if you'd like to switch to the new ribbon, choose View > User Interface > Tabbed. The Tabbed Compact option provides a cut-down version on one line instead of two.

From here, LibreOffice works in a similar – not quite identical – way to Office. You can open and save in Office-compatible formats – to make these the default, go to Tools > Options > Load/Save > General, and make your choice from the Always save as menu.

If you can't find the tool you're looking for in LibreOffice itself (there's an extensive help menu and online user guides if you do get lost), then see if an extension has been written to plug the functionality gap – the step-by-step guide reveals how to track down, download and install them.

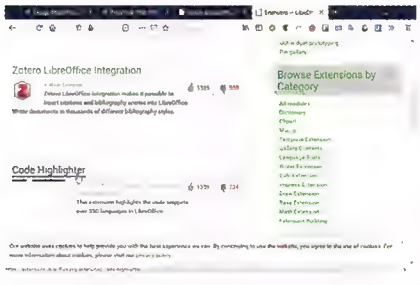


LibreOffice's launcher puts the entire suite at your disposal – including recently opened documents.

Take the time to read the documentation that comes with each one – extensions take up residence in lots of different places.

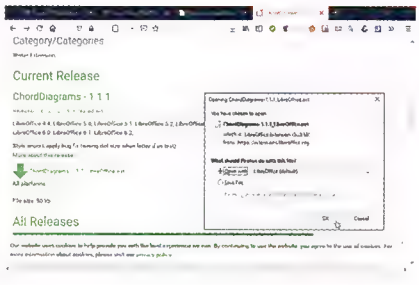
ALSO CONSIDER: If LibreOffice's user interface is too primitive for you, and you only need to replace Word, Excel and PowerPoint, take a look at Softmaker FreeOffice (**www.freeoffice.com**). It offers the familiar ribbon-like interface (or classic menus should you want them) and is compatible with Office formats too.

HOW TO: Expand LibreOffice's capabilities



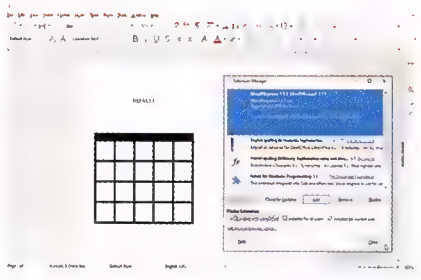
01 FIND EXTENSIONS

Browse to **https://extensions.libreoffice.org** to browse through the nearly 400 available extensions via the Extensions tab. Use the navigation tools on the right to narrow the list by supported application or type (such as macro or dictionary). Click an entry to visit its own page.



02 REVIEW, DOWNLOAD

Review any requirements and dependencies (some add-ons require additional programs to be in place), then scroll down to locate the download link and save the file to your hard drive or – if offered the opportunity – to open it directly in LibreOffice.



03 INSTALL AND RUN

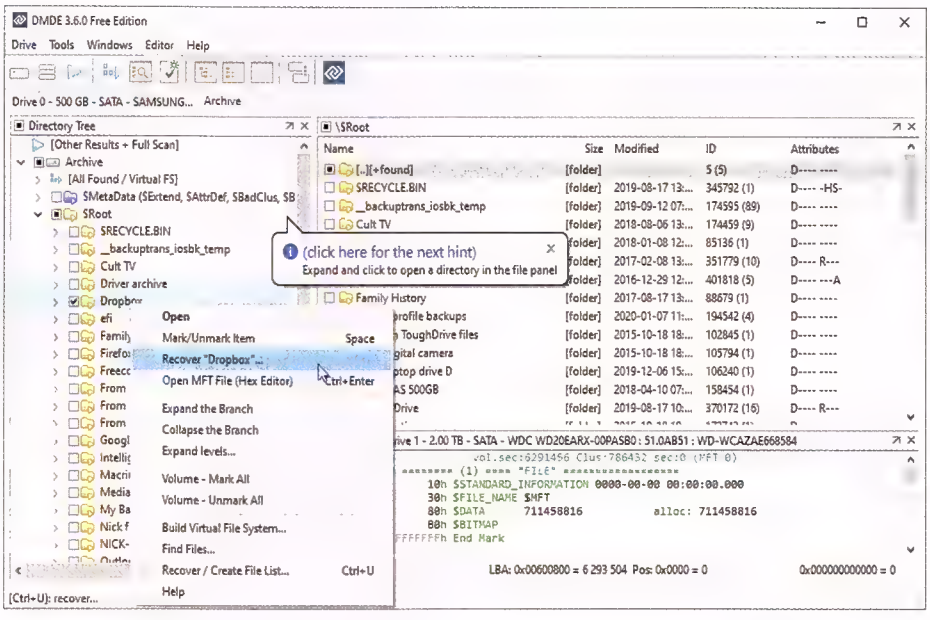
If saved to your drive, open your target LibreOffice application and press Ctrl-Alt-E to open the Extension Manager. Click Add to select the file. The extension should appear in the list. Click Close > Restart Now. The extension should now be accessible as a toolbar or other element.

The ultimate free data recovery tool

DMDE: Rescue all kinds of lost and deleted data from your drives.

Sometimes, despite your best efforts, data loss occurs. It may be as simple as accidentally deleting a file or as major as a partition or entire drive disappearing. Once upon a time, recovery involved expensive fees (and if your drive is physically damaged, you may still need to employ the services of specialists like Ontrack – **www.ontrack.com/au/** – to see if anything's recoverable). Nowadays, though, armed with the right tools you can often get that data back at no cost.

One of the most powerful free tools is DMDE, capable of all kinds of recovery – even from drives rescued from broken enclosures that have been formatted in such a way as to make them impossible to access when removed from their original housing. Download the GUI for Windows version from **https://dmde.com/download.html** – it's a portable tool (see box), so download it to any drive except the one containing your lost data, then extract it to the same drive. Open the folder and double-click dmde.exe to get started (if a SmartScreen warning pops up, click More Info > Run anyway).


DMDE 3.6.0 Free Edition
Drive Tools Windows Editor Help
Drive 0 - 500 GB - SATA - SAMSUNG... Archive
Directory Tree
\SRoot
Name Size Modified ID Attributes
(click here for the next hint)
Expand and click to open a directory in the file panel
Open
Mark/Unmark Item Space
Recover "Dropbox"...
Open MFT File (Hex Editor) Ctrl+Enter
Expand the Branch
Collapse the Branch
Expand levels...
Volume - Mark All
Volume - Unmark All
Build Virtual File System...
Find Files...
Recover / Create File List... Ctrl+U
Help
LBA: 0x00600800 = 6 293 504 Pos: 0x0000 = 0

Recover your data

Step one of the process involves selecting the drive on which your missing data resides – a handy hint steers you towards either logical (for simple data deletion) or physical (for missing drives). If you choose the latter, select your drive and click OK to have it scanned. If you're lucky, the missing partition will show up; if not, click Full Scan and follow the prompts to see if DMDE can recreate it.

To recover data from a detected drive, click 'Open Volume' to browse its contents. If the entire partition was missing, you can now start recovering data from the drive by selecting the folder in the left-hand panel and pressing Ctrl-U to save the files to another drive (the DMDE directory by default). Note, the free version limits you to recovering up to 4,000 files at a time; purchase a licence (either $16 for a single-year licence, or $38 for lifetime) to remove this restriction.

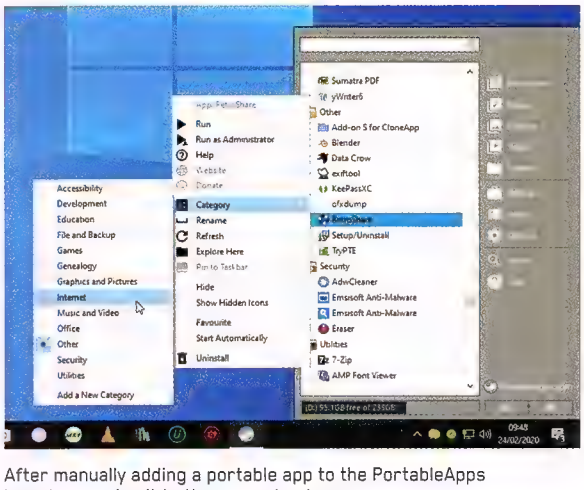
DMDE can recover deleted and lost data from missing partitions as well as regular volumes.

ALSO CONSIDER: If you're put off by DMDE's slightly daunting user interface, try Recuva (download the portable version from **www.ccleaner.com/recuva/features/portable-version**) instead. It's a more user-friendly affair, but not as powerful as DMDE. Our advice: try this first, then switch to DMDE if Recuva isn't able to help.

Build a portable toolkit

Many of the apps we've covered in this feature are available as portable applications, allowing you to store them on a USB flash drive and run them from any PC – or simply use them in the knowledge all your preferences are stored in one convenient location easy to back up and restore after a Windows reinstall. They include Firefox, FastStone Photo Resizer, VLC, LibreOffice, DMDE, Recuva, MusicBee, Winyl, Openshot, EditPad Lite and Notepad++.

The centrepiece of any portable toolkit has to be PortableApps (**www.portableapps.com**), which gives you a handy launcher tool for managing and running portable apps. After installation, launch this and choose Apps > Get More Apps > By Category to install direct from the extensive PortableApps catalogue. But you can also add portable apps manually too (look for a portable download on the program's own website – simply copy the program folder into the PortableApps directory and choose Apps > Refresh App Icons to bring them into view under the 'Other' category. Then right-click the icon and choose Category to move them to a more suitable category.



After manually adding a portable app to the PortableApps launcher, assign it to the correct category.

Edit videos for free

OPENSHOT: Get a fully featured movie-making tool for no cost.

After retiring the excellent Windows Movie Maker, Microsoft didn't bother to develop a replacement. We've yet to see anything truly replace it, but for those looking to edit video in a professional manner – complete with fades, wipes, special effects and title sequences – OpenShot (**www.openshot.org**) fits the bill.

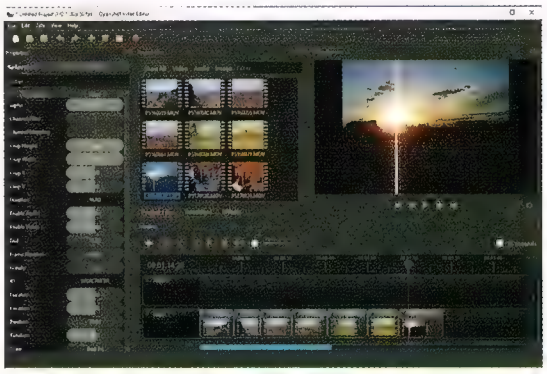
Version 2.5 was recently released, and should address many of the performance issues in earlier versions, allowing you to focus on pulling together your raw materials – video, plus additional images and audio files – before compiling them into a professionally edited movie using OpenShot's various tools.

Movies in just a few clicks

The program's simple drag-and-drop interface is as intuitive as things get. Start with your basic video tracks, then remember the designer's mantra of less is more.

Choose a simple title sequence, then use the same style should you want to add a credits sequence or create other text-based effects for consistency. The same is true with effects – both transition between clips and special effects performed on the footage itself. When it comes to adding titles to your movies, you'll need to install one or both of Blender and Inkscape – both also free and open-source. These can be portable versions and with the release of OpenShot 2.5.0 you're no longer forced to work with an older version of Blender.

"For those looking to edit video with fades, wipes, special effects and title sequences, OpenShot fits the bill"



Drag your clips on to the OpenShot timeline and then work the program's magic to turn them into a polished movie.

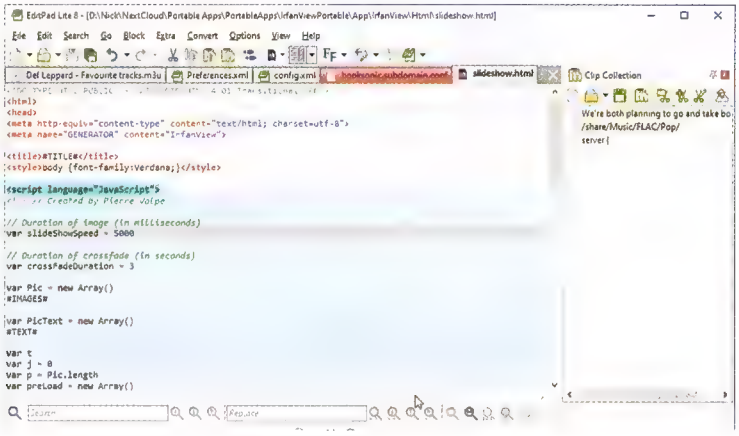
ALSO CONSIDER: If you find OpenShot too buggy or CPU-intensive – even with the latest updates some PC setups still struggle with it – try Shotcut (**www.shotcut.org**) instead.

Upgrade your text editor

EDITPAD LITE: Make editing text (and configuration) files easy with this Notepad replacement.

A text editor does far more than provide the means to edit plain text files. It's often used to edit code, from HTML web pages to configuration files used by programs to store preferences. Notepad falls short on several fronts, but those shortcomings are all fixed by EditPad Lite (**www.editpadlite.com**).

First, it allows you to open multiple text documents at once in a single, multi-tabbed window. There's a more powerful search-and-replace tool with support for regular expressions, and – a game-changer – recently added support for syntax highlighting when writing code. All you need to do is select the correct programming language, from HTML to Python or C++, via the Options > File Type menu, and you'll see your code coloured according to its formatting to help ensure you enter code correctly.



EditPad Lite now supports syntax highlighting when editing code – a major new feature.

Work with clips

Another highlight are EditPad Lite's clipboard tools. Not only can you append new text selections to what's currently on the clipboard, it's also possible to build up a catalogue of frequently used text snippets for quick and easy pasting into documents.

To use this, bring the Clip Collection pane into focus by pressing Alt-F10. Paste clips into here and you can then simply right-click one and choose 'Use Clip' whenever you want to paste it into the document at the current cursor point. Right-click and choose 'Edit Clip' to create different kinds of clips, such as rectangular text blocks.

ALSO CONSIDER: if you need more features, then Notepad++ (**https://notepad-plus-plus.org/**) might prove to be a more tempting choice.

Boost your PC's music player

MUSICBEE: Probably the best music player for your PC – and it's completely free.

With Windows Media Player slipping into obscurity, those who love to listen to music on their PC should install MusicBee (**https://getmusicbee.com/**) instead. Think of it as Windows Media Player on steroids with everything you need to build, organise and – of course – enjoy your audio collection. It even boasts native support for Groove Music.

The app is also geared towards audiophiles with playback controls designed to fine-tune the sounds coming out of your speakers – including a handy graphic equaliser (10- or 15-band) with smart auto-select option to switch the settings depending on what genre of music is currently playing.

Get started

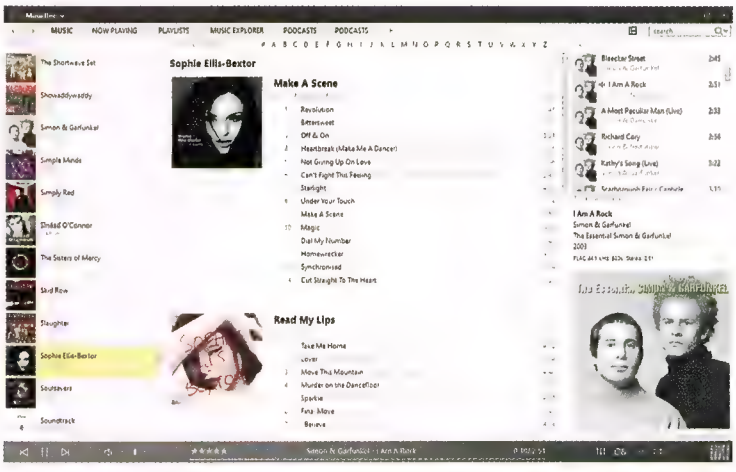
On first launch you'll be prompted to select the location of your music. You can also opt to import tracks and artwork from either WMP or iTunes. Once done, click 'Scan Now'. Your library will appear in an iTunes-like view, with list of artists down the side and the currently selected artists output (organised by album) in the main pane.

Alternative views are available – try Music Explorer for one showing artist bios, top tracks and other information. Click the + button to create your own custom views, then tweak it further by clicking the ? button and choosing 'Arrange Panels' You'll also see a 'Select Skin' option for changing its colour scheme, plus shortcuts to handy mini and compact player views and a useful Now Playing Assistant.

Take the time to explore all MusicBee's menus under its name – and focus on Tools. Here you'll find bonus features like a tool for converting from one format to another, plus tools to help fill in missing tags and artwork for your existing library. Connect your iPhone to sync music, audiobooks and other content between your phone and PC.

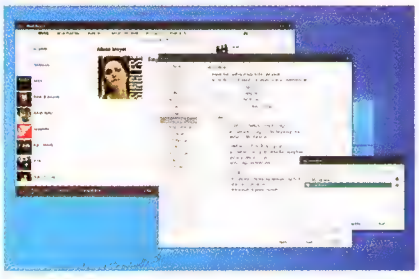
And if all that isn't enough, you can expand MusicBee's capabilities further using plugins – go to 'Edit Preferences > Plugins' to both manage existing ones and add new plugins (get these from **getmusicbee.com/addons/s/?type=all&overview**). Uoi can add support for AirPlay speakers, turn your phone into a remote control and integrate Spotify into MusicBee.

ALSO CONSIDER: If you don't need CD-ripping capabilities and some other advanced features, Winyl (**https://winyl-player.github.io/**) offers all the core music player features you need: play, organise, tag and even stream online radio.



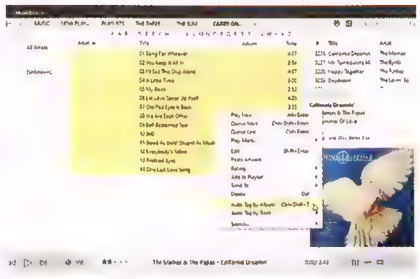
MusicBee is almost infinitely customisable, but sometimes simple is best.

HOW TO: Tag unidentified media in MusicBee



01 ADD GRACENOTE

By default, MusicBee only interrogates the MusicBrainz database for CD information – click ? and choose 'Edit Preferences > Tags (2)'. Click the hamburger (three lines) next to tags, then tick 'Gracenote' followed by Update > Apply to improve your chances of finding a match for your CD.

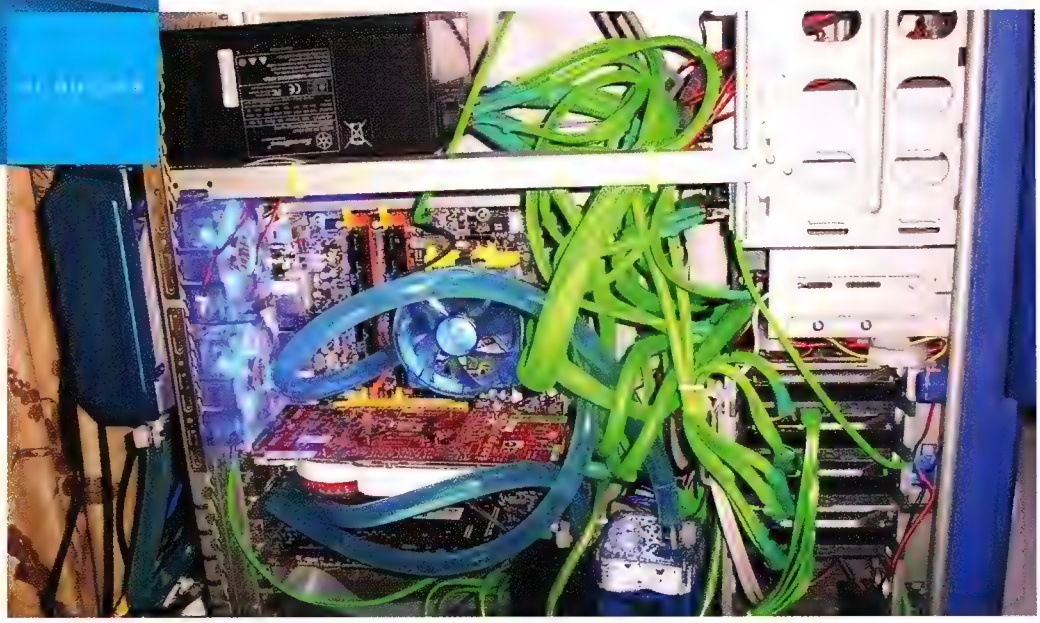


02 TAG BY ALBUM

Click '+' at the top, then use the File pane on the left to navigate to an album folder containing your untagged files. Press Ctrl-A to select all the files in the middle pane, then right-click and choose Auto-Tag by Album to open the Album Auto-Tagger window.

03 ENTER SEARCH TERMS

Type the name of the artist (Various if it's a compilation) and the album name into the relevant fields, then click Find. Browse the results, selecting the correct match. Verify the track names match up, then click 'Apply Tags' to tag the files with the selected information. ■



System News

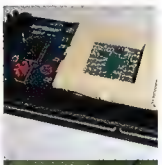
As *APC* turns 40 and looks back at its origins, Mark Williams does the same with his PCs.

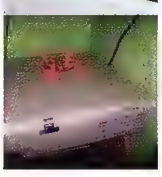
Looking through the first ever issue of *APC* (*Australian Personal Computer* as it was called back then) it's quite amazing to see just how far computer technology has come since the magazine first started.

Apple IIe, Commodores, TRS80, Compucolor II and more, all dinosaurs now with their monochrome CRT monitors and floppy drives. The Compucolor II that was reviewed and tested back in that first 1980 issue touted a minifloppy disc capacity of just 51.2KB, with access times of 400ms and a transfer rate of 76.8bps. Laughable by today's standards and apparently even slow for its time according to the article, but it does help illustrate just how far computers have come since.

My PC journey began properly when I was given a Hewlett Packard PC sporting an Intel 486-DX2 processor in around 1994. While I'd used the family Apple II and 386-based computers before, playing games like *Hocus Pocus*, *Dig Dug* and *Load Runner*, this machine I could call my own.

It was with this computer that I got hooked on PCs. Windows 3.11 had a GUI interface that even a young little whipper snapper could get a grasp of easily to explore possibilities and got me going on the first big budget game title I ever played, Westwood Studios' *Command & Conquer: Red Alert*. The full motion videos between missions blew my mind and the gameplay was complex and engaging. It took me what felt like months to complete both campaigns. All these years later I have realised why that might've been. I had a 486-DX2 which ran at a sedate 50MHz. *C&C:RA*'s system specifications at the time called for a 66MHz 486 minimum with a 100MHz 486 being the recommended. The game must've been running slowly the entire time! Not that I would've cared, the visual effects and graphics looked amazing not to mention the rocking soundtrack.





After that came my next PC, a Dell Optiplex GX1 which had an Intel Pentium II 400MHz processor. This began to teach me the possibilities of what you can do with the hardware. While hard drive and CD-ROM drives were easy upgrade paths, along with RAID cards, I learnt that discrete graphics cards were a worthy thing to support my growing gaming habits and so I bought a Nvidia Riva TNT2 M64 for it. I later caught wind of something called a Slotket. A riser board adapter that converts the cartridge style Slot 1 of the Pentium II into a Socket 370. This was another mind-blowing situation when I figured out that I could upgrade my 400MHz CPU to a whopping 1400MHz Celeron. And boy did it work, though I then had big troubles with temperatures even with a beefy all-copper heatsink installed. The PC had a flatbed style orientation and was quite thin and thus had poor airflow. So, I got my father to help cut a big ol' hole in the top of the case above the CPU socket where we mounted a "massive" 120mm fan to shove air directly into the heatsink. Looking like a muscle car with the engine popping out of the hood, it was ugly but so satisfyingly cool in both senses of the word.

While others were overclocking their Celerons to 1700MHz+ speeds, I frustratingly had to give up on that path of adventure as my motherboard couldn't change front side bus speeds with the Slotket. It was still mightily impressive and taught me a lot about PC building, upgrading and just how expandable PCs can be.

Shop Talk

Tell us about the first PC you ever owned or built. What do you remember about it?

JAIMIE, LEADER COMPUTERS:

"My first PC was cobbled together out of shop scraps where I was working at a computer retailer.

I was super proud of that ugly beige PC. It was running a Pentium II 300, overclocked to 450MHz! It was the type that was on a riser board off the CPU, and looked like it would flop out at any second. I had a Diamond Stealth 1MB graphics card which I upgraded to two whole megs, and a Voodoo 2 8MB 3DFX card for that sweet *Unreal* and *Quake* action (I couldn't afford the 12MB!).

Don't forget the ever reliable (NOT) Bigfoot Quantum drive... I seriously don't know how I ever got the thing to run but run it did for three good years. By then AGP had well and truly emerged and the game had changed.

Every component inside was a different shade of blue or baby-poo-brown; thank God we didn't have tempered glass back then!"

Market Snapshot

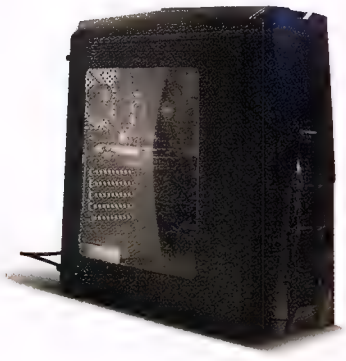
A sampling of PC systems available this month.

$1,249, tinyurl.com/APC481SCO

Scorptec Hornet Core i5

On the face of it, the price doesn't match the specs of this machine. The six-core i5 9400 is good, but with 8GB of RAM and, crucially, no graphics card, this system is a little out of its league compared to the other systems this month. The discrepancy comes from the software bundled with this system, namely Microsoft Office Home & Business 2019 which alone normally costs around $300. Knowing this, we can see this is really a $950 PC. Focusing on working at home and not gaming, this system all of a sudden looks like a nice buy. 8GB of RAM is enough for most office work use and while the 250GB SSD isn't the most spacious, it'll certainly hold quite a lot of work.

CPU Intel Core i5 9400, **COOLER** OEM, **MOTHERBOARD** MSI H310M Pro-M2 Plus, **GRAPHICS** Integrated, **MEMORY** Crucial CT 8GB 2400MHz DDR4, **STORAGE** Western Digital Blue SN500 250GB M.2 SSD, **POWER SUPPLY** Cooler Master 420W, **CASE** Cooler Master MasterBox E300L.



$1,299, tinyurl.com/APC481JWC

JW Computers GMR Elemental 570

As the only AMD system this month we were expecting a little bit more from this rig. While no slouch, the Ryzen 3 3200G is just a quad core CPU. Sure, it has SMT to provide double the thread count, but if gaming is the aim, this will be your bottleneck versus the likes of the i5 9400. For the same price a Ryzen 5 1600AF would've been a better option. Paired with a B450 chipset motherboard, though, means you'll be able to drop in any AM4 CPU in the entire range for an easy upgrade later on. The venerable RX 570 is showing its age now but will still get you by in lighter gaming titles at 1080P.

CPU AMD Ryzen 3 3200G, **COOLER** OEM, **MOTHERBOARD** AMD B450, **GRAPHICS** AMD Radeon RX 570, **MEMORY** 8GB DDR4, **STORAGE** 240GB 2.5-in SATA SSD, 1TB 3.5-in SATA HDD, **POWER SUPPLY** Thermaltake 600W, **CASE** Thermaltake Versa N25.

$1,299, tinyurl.com/APC481PHO

Photech Computers 9400F GTX 1650 SUPER

This system offers the most value of all the systems this month. With six fully fledged cores it offers a good amount of processing grunt for most tasks in this price category, even gaming. Speaking of gaming, Photech has managed to squeeze a GTX 1650 Super into this system, giving it far and away the best gaming performance of all the systems this month. Incredible value. This will run most games at 1080p at 60fps; even more demanding game titles will stay above 40fps. A sizable 500GB SSD and 16GB of RAM make for a very spacious feeling PC at an incredibly low price that won't age quickly.

CPU Intel Core i5-9400F, **COOLER** OEM, **MOTHERBOARD** Asus TUF H310M-Plus Gaming, **GRAPHICS** GeForce GTX 1650 SUPER 4GB, **MEMORY** Team Vulcan (2x8GB) 2666MHz DDR4, **STORAGE** WD Blue SN550 M.2 NVMe 500GB SSD, **POWER SUPPLY** Fractal 500W, **CASE** Fractal Focus.

$1,299, tinyurl.com/APC481AUS

Austin Computers G18

Sporting the weakest CPU of the roundup with just four cores and no hyperthreading, this system is already on the back foot. The motherboard is solid for this price category, but quite uninteresting. The memory is over-specced for what the CPU is rated for. The SSD is bargain bin tier, but at least it is reasonably sized at 480GB. The case and power supply are reasonably good though and afford this system the best aesthetics of the bunch. With the graphics card being on the older side of things too, this whole system – for its price – seems a little lacklustre. There is nothing to stand it out from the rest aside from the aesthetics, ultimately making this a system you should overlook.

CPU Intel Core i3-9100F, **COOLER** OEM, **MOTHERBOARD** Asus Prime B365M-K, **GRAPHICS** Asus Expedition Radeon RX 570 4GB, **MEMORY** Adata Premier 16GB DDR4 2666MHz, **STORAGE** Crucial BX500 480GB SATA SSD, **POWER SUPPLY** Cooler Master MWE 550W, **CASE** Cooler Master MasterBox Lite 3.1.

BLUEPRINTS

VALUE- AND PERFORMANCE-DRIVEN HYPOTHETICAL BUILDS

PC BUILDER

Budget

A modest overall price rise from our last issue.

There are some small increases here and there, but the Budget build is still in a really good place right now, so we're not making too many changes here. A switch back to the 2x 8GB Team T-Force Vulcan Z memory kit was predicated by the GeiL Evo Potenza RAM no longer being on sale, and we also swapped back to a twin-fan GPU, specifically Zotac Gaming's standard 6GB model of the GTX 1660 Super, which happened to be 10 dollars cheaper than the previous EVGA GPU. We also made the change from Adata to Patriot's Burst 2.5-inch SSD, sticking with the same amount of SATA storage (to keep our boot-ups nice and swift), but saving ourselves a few dollars, because the Adata SU650 is also no longer on sale at the time of writing. Patriot's drive is super-cheap and will do everything we need it to do here.

"Thanks to some small increases here and there, but the Budget build is still in a really good place right now"

PART		PRICE
CASE	BITFENIX NOVA TG	$75
PSU	THERMALTAKE SMART BX1 80+ 450W	$65
M/BOARD	GIGABYTE B450M DS3H	$115
CPU	AMD RYZEN 5 2600	$199
GPU	ZOTAC GAMING GEFORCE GTX 1660 SUPER 6GB NEW	$409
RAM	16GB (2X 8GB) TEAM T-FORCE VULCAN Z @ 3,000MHZ NEW	$140
SSD	120GB PATRIOT BURST 2.5-INCH SATA III NEW	$54
HDD	1TB WESTERN DIGITAL BLUE HDD	$59
OS	UBUNTU DESKTOP LINUX 18.04.3 LTS 64-BIT	$0
PRICE:		$1,116

Mid-range

It's Intel time.

Our mid-range build is making the shift over to Intel this month; we've been all over AMD for long enough. The Core i5-9600K we're using is a bit more expensive than the third-gen Ryzen chip it's replacing, but it also outperforms it on average by a small amount, and removes the need for an expensive X570 motherboard. So, we've got Asrock's Z390 Steel Legend coming in, too, and a powerful Corsair A500 air cooler, because we'll be missing the free Wraith cooler AMD provides. We're slightly increasing our available power with a new 550W CV PSU, also from Corsair. We're making the same memory change as in the Budget build, and swapping over to MSI for the GPU, because the XFX RX 5700 was no longer on sale. Lastly replacing the SSD with a cheaper, more suitable PCIe 3.0 drive, the BarraCuda 510 from Seagate.

"The Core i5-9600K we're using is a bit more expensive than the third-gen Ryzen chip it's replacing, but it also outperforms it"

PART		PRICE
CASE	FRACTAL DESIGN MESHIFY C	$149
PSU	550W CORSAIR CV550 80+ BRONZE NEW	$82
M/BOARD	ASROCK Z390 STEEL LEGEND NEW	$239
CPU	INTEL CORE I5-9600K NEW	$399
COOLER	CORSAIR A500 DUAL FAN NEW	$139
GPU	MSI RADEON RX 5700 8GB NEW	$569
RAM	16GB (2X 8GB) TEAM T-FORCE VULCAN Z @ 3,000MH NEW	$139
SSD	500GB SEAGATE BARRACUDA 510 M.2 PCIE SSD NEW	$198
HDD	1TB WESTERN DIGITAL BLUE HDD	$59
OS	WINDOWS 10 HOME 64-BIT OEM	$140
PRICE:		$2,113

Turbo

The parts they are a-changin'.

The EVGA RTX 2080 Super is no longer on sale, so we also had to switch manufacturers on our GPU, keeping the price relatively low with the excellent-value 8GB Ventus model from MSI. We hadn't intended to swap out our power supply, but the G+ version of the 850W EVGA SuperNOVA leapt in price, so we switched over to its GA counterpart.

Lastly, we replaced the cooler. We wanted to stick with the triple-fan setup to ensure maximum cooling for our Threadripper 2950X, but our previous 360mm Fractal Design cooler had risen in price a tad much for our liking, so we found a replacement: the EVGA CLC 360, a powerful but minimalistic AIO cooler with three low-noise nano-bearing fans, and an RGB-lit pump block. EVGA's free Flow Control software enables you to tweak both the pump and fan speed with ease, and the combination bracket means it is fully compatible with TR4-socket Threadripper processors.

"We wanted to stick with the triple-fan setup to ensure maximum cooling for our Threadripper 2950X"

PART		PRICE
CASE	NZXT H700I	$229
PSU	850W EVGA SUPERNOVA 850 GA 80+ GOLD NEW	$249
M/BOARD	ASUS PRIME X399 TR4	$459
CPU	AMD THREADRIPPER 2950X	$1,199
COOLER	EVGA CLC 360 NEW	$179
GPU	MSI GEFORCE RTX 2080 SUPER VENTUS 8GB NEW	$1,349
RAM	32GB (2X 16GB) G.SKILL TRIDENTZ RGB @ 3,600MHZ NEW	$410
SSD	1TB SEAGATE BARRACUDA 510 M.2 PCIE SSD NEW	$150
HDD	2X 3TB SEAGATE BARRACUDA COMPUTE NEW	$417
OS	WINDOWS 10 HOME 64-BIT OEM	$140
PRICE:		$4,781

BUILD IT

The gaming & media tower

Zak Storey knows there's nothing quite like overkill for a living-room gaming PC.

Let's be real here: This is overkill. Massively. We'd pitch this as a "console killer," but if we're being honest, with a price tag this large, you could probably buy eight PS4 Pros and still have enough cash left for six crates of beer and 20 packs of chips. In fact, this build is nothing short of gluttony. So, what was the aim of it? What did we set out to achieve with this rig? It was all about building something that could act not only as a big showpiece or ornament for the living room, but also as a system that could comfortably and quietly game at 4K on the big screen. And, of course, all from the comfort of your couch.

Our case of choice for this build is the Phanteks Evolv Shift X chassis. It's a long, monolithic ITX case, with an expressive internal structure and layout. It supports a hefty amount of hardware internally, including liquid-cooling radiators – but there are some limitations, thanks to clearance. In fact, most builds using the Shift X typically incorporate a single 240mm radiator and then call it a day. We knew, though, that this just wasn't going to be enough for the hardware we had in mind, so we opted to slot in an additional 120mm radiator at the bottom.

We were also lucky to have a Shift X chassis in our lab, but they can be hard to find in the shops, though not impossible. Feel free to substitute your case of choice if you're mirroring this build.

ZAK STOREY
Zak returns after a short break away, and was so keen to build something excessive we let him do this.

"We'd pitch this as a "console killer," but if we're being honest, with a price tag this large, you could probably buy eight PS4 Pros and still have enough cash left for six crates of beer and 20 packs of chips."

Thermal Woes

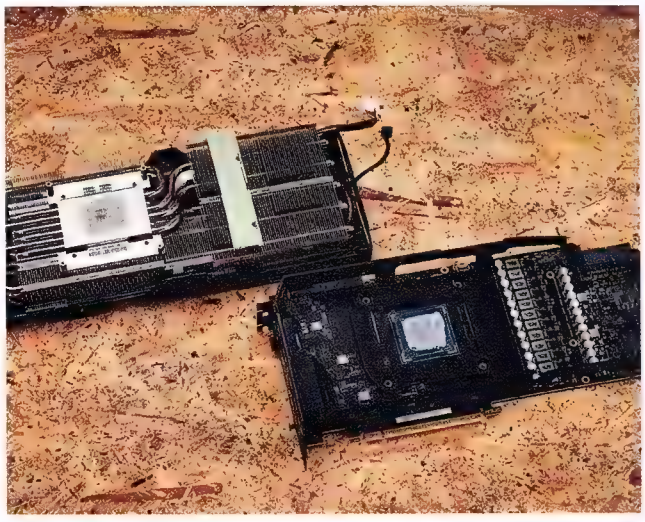
The big issue with this build was balancing the hardware choices with the thermal capacity. Because we were going to be running a complete loop, and cooling the GPU as well, it was imperative that we got this right. We knew a single 240mm radiator would be more than enough for any processor we could pop in here, but adding a GPU complicates matters. There certainly wouldn't be any headroom for overclocking, that's for sure.

So, let's look at the main heat-generating components. First up is the Ryzen 5 2600X. Now, this is a fairly solid all-around processor, it's got a TDP of around 95W, and it comes with a beefy six-core, 12-thread setup, and a healthy clock speed that we can drop with the voltage if need be. For just gaming, it should be more than enough at 4K and beyond.

As for the GPU, we went with a fairly high-spec RTX 2080. We could have gone with a Ti model, which would have realistically been better for those 4K frame rates, but the Ti also comes with a 250W TDP – the RTX 2080, on the other hand, has a TDP of just 215W. That's a fairly substantial drop in overall power draw, making it ideal for our slim 360mm-rad setup. Outside of that, and to minimise the number of cables we'd need, we picked up a 1TB WD Black SN750 PCIe SSD. That was actually a mistake on our part. We assumed it would be like the latest Corsair Force PCIe 4.0 drives, and it would be easy to remove it from its heatsink. Oh boy, were we wrong – you need specialist torque screwdrivers, which are smaller than any we could find at the local hardware stores, but more on that later....

PART		PRICE
CASE	PHANTEKS EVOLV SHIFT X	$325
MOBO	ASUS ROG STRIX X470-I GAMING	$390
CPU	AMD RYZEN 5 2600X	$245
GPU	ASUS ROG STRIX GEFORCE RTX 2080 OC EDITION	$1,358
MEMORY	16GB (2X 8GB) CORSAIR DOMINATOR PLATINUM RGB @ 3,200MHZ	$219
PSU	750W CORSAIR SF750 MODULAR 80+ PLATINUM	$239
STORAGE	1TB WD BLACK SN750 PCIE NVME M.2 SSD	$375
COOLING	ASSORTED PHANTEKS, ALPHACOOL, MAYHEMS	$2,000
120MM FANS	3X PHANTEKS PH-F120MP PWM (BLACK)	$270
140MM FANS	1X PHANTEKS PH-F140MP PWM (BLACK)	$35
OS	WINDOWS 10 HOME 64-BIT	$140
TOTAL		$5,596

"To minimise the number of cables we'd need, we picked up a 1TB WD Black SN750 PCIe SSD. That was actually a mistake on our part. We assumed it would be like the latest Corsair Force PCIe 4.0 drives, and it would be easy to remove it from its heatsink. Oh boy, were we wrong"

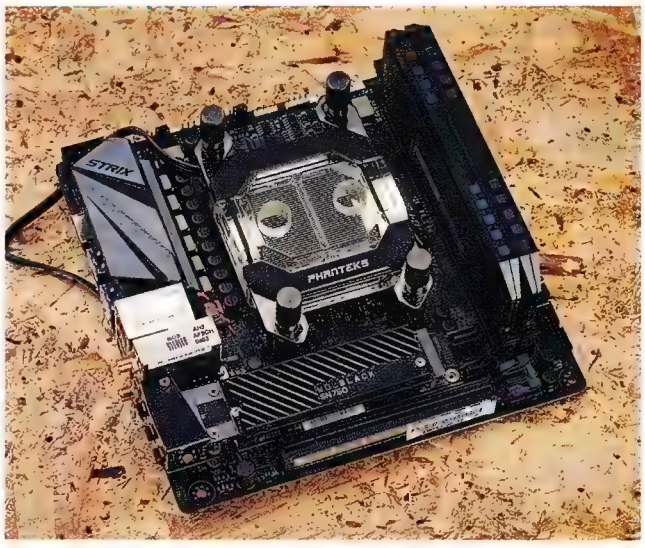


01 GPU STRIP-DOWN

It's always worrying when you have to strip down a graphics card to attach a waterblock. There's so much that can go wrong, it just doesn't bear thinking about. Just take your time, be careful, and make sure you don't overdo it with the screws. Asus's GPUs are fairly simple to take apart: Remove the backplate screws, those surrounding the GPU, and the card slowly pulls apart. Just remember to unclip the fan cables and RGB cables. For this build, we took advantage of a Phanteks waterblock for the first time. It doesn't come with a backplate for the Asus graphics card, so instead we reinstalled the GPU backplate after we'd finished. That means we still have the Asus ROG RGB logo illuminating the back of the card, entirely controllable in software.

02 CASE DISASSEMBLY

With the graphics card blocked, it's time to strip down the case. The Phanteks Shift X is a pretty easy chassis to disassemble. The two tempered glass panels have thumbscrews at the top, near the rear I/O (which is also where the power button is). You simply pop up the top rear I/O panel – it's on a spring mechanism – loosen the thumbscrews, and slide the solid glass windows up and out. Stick them in the case box for safe keeping. The front and rear brushed aluminum panels follow a similar procedure. There are two thumbscrews either side, situated at a horizontal angle instead of vertical, then they just slide off. Inside you'll find an accessory box with drive trays, screws, and a nifty little box. We've also removed the power supply cover here as well.

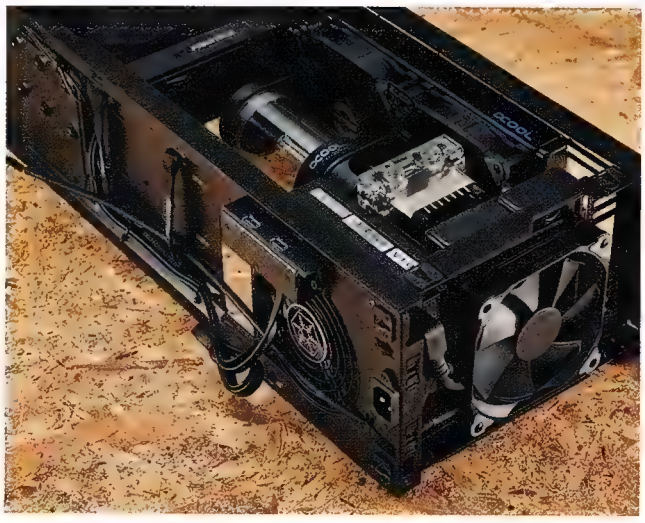


03 MOTHERBOARD PREP

Next, it's time to move on to the motherboard. This presented a number of problems. First up was the block itself. Phanteks is fairly new at the waterblock game, and rather frustratingly, the block has two cables that you need to attach to control the RGB lighting at the top and bottom, and then find a way to route around the board. And then there was the hard drive. As we mentioned earlier, we didn't have the necessary tools to remove the heatsink, so that left us with just one option: Simply don't reinstall the stock motherboard M.2 heatsink. Ultimately, that does mean you lose out on a little RGB, but let's be honest – does that really matter all that much? We don't think so.

04 RADIATOR FITTING

Installing the 120mm radiator was a nightmare–the shot you see below isn't even the correct orientation yet, as the ports are facing the power supply. We ended up moving it 90 degrees clockwise, so the ports face the window instead. This enabled us to mount our pump in a better position, to allow for easier tubing runs. You may have also spotted that it's not a Corsair power supply. We intended to use a Silverstone Strider, but even as an SFX power supply, it was too tight against the power supply cover. In the end, we went for the Corsair SFX PSU as it's a bit shorter than this one. We've also removed the kettle lead pass-through cable, as it's almost impossible to plug it in while attached to the case. You first to plug the pass-through into the PSU, then reinstall it to the case.



05 RESERVOIR RUMBLE

At this point, we still hadn't figured out that the Silverstone power supply was no good, but it was all about fitting that front radiator and getting the reservoir into position. We're actually using a separate bracket from Alphacool for this – as it's got channels down, you can orient them in different ways to give you better clearance and move the reservoir up and down as needed. It's not the cleanest look in the world, but it works well when you're trying to suss out those tubing runs on the first pass. We've also installed the LED RGB Alphacool ring. It's quite old-school in a lot of ways, as it isn't compatible with motherboards, and instead plugs in via Molex, then has a physical wired remote to control color and illumination patterns.

06 PUMP POSITIONING

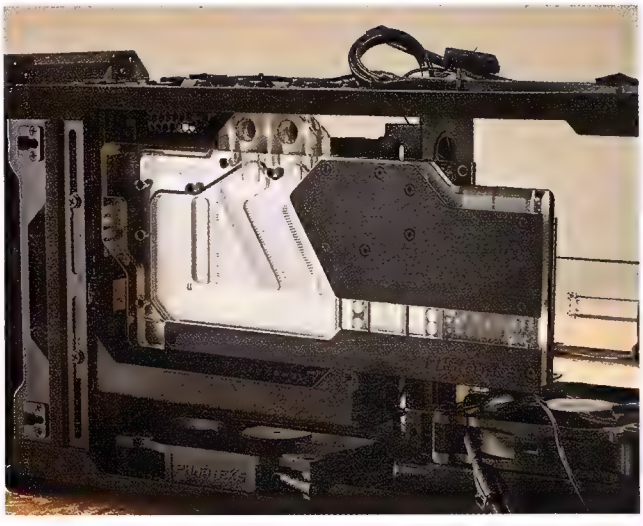
By now, we've realised that having the radiator ports facing the PSU is a no-go, so we've reoriented it to the correct position, with the ports close to the glass window. And we've also taken the opportunity to mount the pump to the top of the radiator, raised off it – this time, with the included Phanteks pump mount that came with the case. You can mount the bracket directly to 120mm fan mounts on a case, making it perfect for our bottom radiator. We're still tinkering with the positioning here, and it turns out that the pump itself is too close to the window to allow for the 90-degree fittings that we're inevitably going to need to install. Fortunately, the pump mount bracket has multiple slots to which you can attach the pump.

07 FITTING INFURIATION

This is the point we found out it wouldn't all fit. It's always smart to keep a few fittings out to see if you're going to run into any conflicts, and this is a prime example. Pump in, radiator in the correct position, reservoir sort of right, angled fitting in. Will the glass panel fit on? No. Back to the drawing board. Infuriating doesn't quite cover it. Especially as a lot had to be removed to move it back. This was also the first time we began to get an idea as to what tubing runs would be going where. Unlike most cases, where you can easily plan your tubing runs, the Shift X has a split compartment, with each segment consisting of half the case. With the motherboard on one side and the graphics card on the other, deciding how to position your tubing runs can be difficult.

08 CABLE AWARENESS

Finally, we could turn our attention to the motherboard itself, and it was clear fairly quickly that there were going to be some major issues here with regard to cabling. In fact, between that top-left corner and the fan, we'd somehow have to run an eight-pin power cable, plus all the fan cables, and the RGB cables. And then, of course, there were the tubing runs to fit in, too. The most obvious route – and something we'd eventually commit to – was to go straight through the top plate, around the rear I/O, and then down to the graphics card, although that would require some significant cutting and a pass-through to get working.

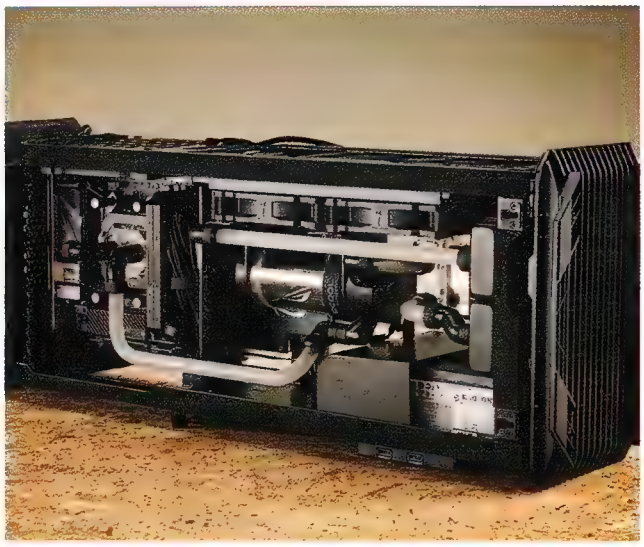


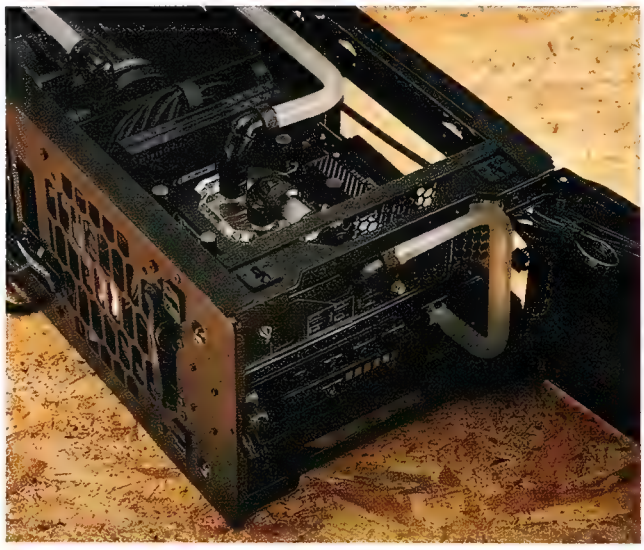
09 GRAPHICS CARD INSTALLATION

With that sorted, we moved on to the graphics card. As standard, the graphics card mounting solution, rather bizarrely, runs the GPU with its backplate facing the window (we're guessing for better airflow). However, that doesn't make a whole lot of sense for a liquid-cooled waterblock that you want to display, so instead we had to flip it – to do this, you need to remove the GPU bracket entirely. It's mounted on the back of the motherboard tray with a couple of screws. So, take it out, flip it upside down, remount it, and you'll be good to go.

10 THE PERFECT FIX

So, fittings in, let's crack on with the tubing. This is what we ended up with for the reservoir and pump setup. As you can see, the pump is still gravity-fed (though you do need to get past that center fountain tube in the res first). It flows down and around into the bottom radiator, and then up into the 240mm radiator, where it then goes around the back into the graphics card, through the block, around the top of the case, down into the CPU, and then back into the reservoir to repeat the cycle again. At least, that's the plan. We love the look of the frosted tubing here. Alphacool really has nailed it with this stuff, and with the pastel pink coolant as well, this stuff will shine. The only downside? There are no LEDs in that pump, and it could really use some.



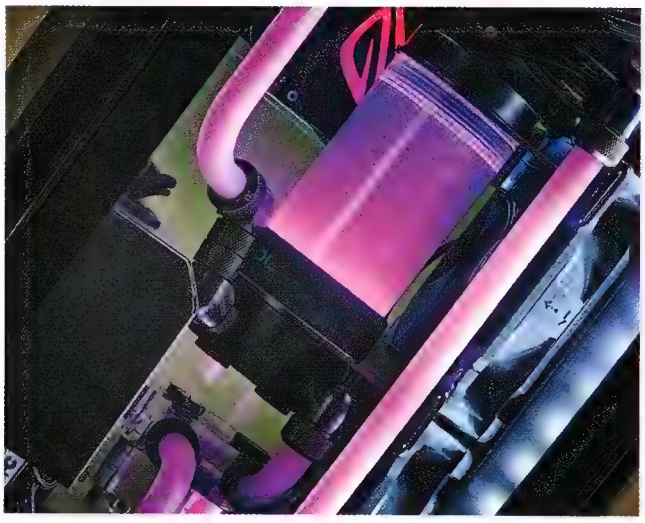


11 FINISHED FRONT SIDE

This is a good side-on shot of where we were heading with the tubing design at this point. And if you're thinking, "But you always said a single 90 bend is best," yeah, you'd be right – that tube connecting the reservoir and the CPU is a stroke of luck. Getting the angle right was the hard part, because you've got one straight 90, then a separate one going to the reservoir. Fortunately, we were saved by fittings. There's a snakehead on the CPU portion, and two 90s on the reservoir that allow us to adjust the angles by just enough so that even if we're out with the length or where the bends are positioned, we can readjust the fittings to compensate.

12 I/O PASS-THROUGH

On to more dual-bend tubing runs – this was the hardest to get right. We cut through the I/O grille at the top and attached a pass-through. Bizarrely, it had one side longer than the other, so we used the clean side on the top of the case, near the I/O, and the threaded side near the CPU, because the top panel wouldn't close once a 90-degree fitting was attached, as it came into contact with the power switch. So, we rotated the fitting, which gave us enough clearance. The tubing run is not as straight as this photo makes you think, but it bends nicely, then provides a clean line to the graphics card. It took a few attempts to get right, but it does the job perfectly, although installing I/O cables was a heart-wrenching moment, as they had to slide beneath the tubing.



13 GRAPHICS CARD DISPLAY

With the tubing complete, the cables plugged in, and the coolant power-cycled, the build was complete. We did a quick and dirty install of Windows to configure the RGB lighting, and it looks really good. The graphics card, in particular, with its integrated LED lighting, really pops. We set it to white, to make it shine, as it highlights everything else without submerging it all in pink. There's a little air bubble, but over time it will move to the reservoir, and we can replace it with some good coolant. This build wasn't as seamless as you'd think, though, as we'd forgotten to tighten the two plugs on the other side of the GPU block, and coolant dripped on to the PCIe power connectors, which was as terrifying as it sounds. But after it dried out, it worked flawlessly.

14 RESERVOIR GLOW

Here we have a final showpiece shot, showing off the Alphacool reservoir. It's filled with Mayhems Pink Pastel coolant, and illuminated by means of the LED ring situated at the bottom. You can move that up and down, depending on what you want, and the light will shine out in both directions. It's quite effective, but we've decided we prefer it located at the bottom, just so it illuminates upward in that cool gradient glow. As well as that, we've also kept the ROG logo on the backplate of the GPU red. It's actually picking up a little of the light from the pink coolant, too, which gives it that edgy pink-red gradient effect as well.

Building Complete

This is a special build for a number of reasons, not only because it's Zak's first build since his return to the magazine, but also because it's pink. And there's a story behind that, as there often is with these systems. In short, Zak asked his significant other what color she thought the coolant should be, and she replied, "Pink!" Not because she's female, but because it's one of her favorite colours. And, to be honest, we were more than happy to oblige. Reason being, in the publishing industry, especially in the technology sector, pink is seen as a feminine color, and management doesn't really like it. After all, the majority of our audience is male. Because of that, we've always had an in-joke among the team that it's secretly a hyper-masculine color, and should therefore be called MANgenta. Because, in our eyes, the fact that management thinks it's not manly makes us think it is. In fact, during Zak's original tenure on the magazine, he threatened the executive editor multiple times with making a pink liquid-cooled PC, because that was the only way to get mangenta on the cover.

That said, after this was built, the pink really does work quite nicely. Combined with the white lighting thrown out by the various LEDs situated across the components, it really does make the machine pop. In fact, it's one of our all-time favorite builds. Aesthetics aside, it's not perfect – it has some serious problems. Some that stem from building a show build like this, others due to overlooking stuff from a thermal perspective. It is way too hot; even with no overclocks, the system traps heat after two or three hours, and the fans ramp up anyway, negating a lot of the benefits you find from liquid cooling. The stock Phanteks fans we picked weren't sufficient, and ideally should be replaced with Noctua NF-F12s, Corsair ML120 Pros, or EK-Vardar fans. Something with high static pressure and low noise. Alternately, if Phanteks releases a mesh variant case, as it has done with the smaller Evolv Shift model, that may help, too.

It could also use some custom cables made to length specifically for it, because the Corsair Pro ones, although a fantastic kit, add far too much bulk to the cable-management space. And then there's the show-build element. With most of the liquid-cooled systems we build for the magazine, they have to be put together quickly, considering aesthetics above all else. That means there is usually only one fill port on a build. For long-term use, you need a drain port at the lowest point, too, because it makes it far easier to maintain your loop. We're using Mayhems coolant here, which is particularly long-life, but if we wanted to swap that out, it would be a real pain.

Build process aside, it's a fairly solid PC for living-room gaming. It's not a seamless experience, though. To get it set up properly, you need a standard install of Windows with a local account and no password. Then it's a case of configuring Steam to open in Big Picture Mode on startup, at which point you have access to your entire library. In fact, you can even link Uplay and other titles with Steam, too, although you need a keyboard and mouse handy from time to time.

Ultimately, our Pink Pariah is a gorgeous showpiece that can manage gaming at 4K, unhindered by any game you throw at it (with a little tweaking, of course), and it's more than ideal for your living room. Expensive? Yes. Very. And you could achieve something similar for half the cost.

01
There's actually a Phanteks branded magnetic cable cover that goes across here, but with the 24-pin cables in place, it was easier to remove it than secure it.

02
We had to use a fan splitter cable here, because the motherboard only has three fan headers, and we have a total of four fans in the build.

03
We've also not plugged in the front USB 3.0 header for these two ports, because there's simply not enough space for them up there.

04
This is our rudimentary fill port: just an angled 90-degree fitting and a plug. It's simple and easy, and means we can perform coolant maintenance when necessary.

APC LABS BENCHMARKS

CINEBENCH R15 MULTI (INDEX)	CRYSTALDISK QD32 SEQUENTIAL READ (MB/S)	CRYSTALDISK QD32 SEQUENTIAL WRITE (MB/S)	*MIDDLE EARTH: SHADOW OF WAR* (FPS)	*TOTAL WAR: WARHAMMER II* (FPS)	*ASSASSIN'S CREED ODYSSEY* (FPS)	3DMARK: FIRE STRIKE (INDEX)
GAMING & MEDIA TOWER 1,320	GAMING & MEDIA TOWER 3,438	GAMING & MEDIA TOWER 2,955	GAMING & MEDIA TOWER 49	GAMING & MEDIA TOWER 38	GAMING & MEDIA TOWER 32	GAMING & MEDIA TOWER 19,597
ZERO-POINT 1,701	ZERO-POINT 3,522	ZERO-POINT 2,237	ZERO-POINT 56	ZERO-POINT 44	ZERO-POINT 35	ZERO-POINT 22,503

Our zero-point consists of an Intel Core i7-8086K @ 5.3GHz, 32GB Kingston HyperX Predator DDR4 @ 3,200MHz, an Asus GeForce RTX 2080 Ti Turbo, and a 512GB Samsung 970 Pro M.2 PCIe SSD. All tests were performed at 4K at the highest graphical profile.

QUICK TIPS

Experts solve your computing problems

The *APC* team tackle problems across the spectrum of devices and software we use. Learn a new trick or fix you can use.

WINDOWS

Fix Windows Update

My laptop has stopped installing updates since the 1903 update a couple of months ago. It gets to seven percent, then rolls back. Can you help?
RAYMOND WHITEHALL

We stepped Raymond through all the standard procedures, including downloading the update manually and running the built-in troubleshooter under 'Settings > Update & Security > Troubleshoot'. We also helped him take his first ever system backup using Macrium Reflect Free (**www.macrium.com/reflectfree.aspx**) in case anything disastrous happened with our more root-and-branch repairs.

Once done, the next step was to elicit the help of the free version of Windows Repair. Download and install it from **www.tweaking.com** – once done, you'll need to reboot into Safe mode. To do this, press Win-R, type "msconfig" and press Enter. Switch to the Boot tab, tick 'Safe boot' and select Network, then click OK. Reboot when prompted and you should be taken straight to Safe mode.

Now open Windows Repair and work through the four steps (you can skip the power reset in this instance). The pre-scan is crucial for determining the Windows Package Files are all present and correct (ignore any reparse errors). Run a file-system check (click Check) – if errors are found, run a reboot and check to fix them.

Finally, don't skip the System File Check – this is where you may come across corruption that needs repair.

Once these general checks and repairs have been made, make Registry and System Restore backups when prompted, then click the 'Preset: Windows Updates' button to select all repairs related to Windows Update. Finally, click Start Repairs – once complete, your PC will reboot to Safe mode. Open msconfig again, but this time untick 'Safe boot' under the Boot tab before clicking OK and returning to Windows proper.

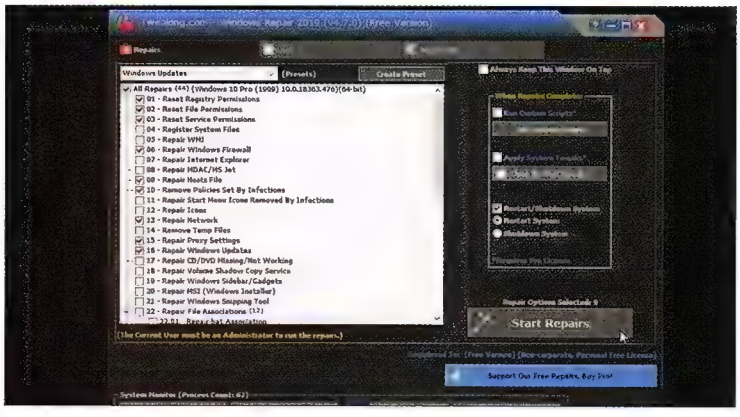
APPLICATIONS

Quicken startup error in Windows 10

After transferring my old Windows 7 setup to a new Windows 10 PC using Laplink PC Mover I get the following error on bootup: 'BILLMIND.EXE – System Error. The code execution cannot proceed because IPROF32. DLL was not found. Reinstalling the program may fix this problem'.
TOM HIRONS

BILLMIND.EXE is a startup program related to Quicken, which hasn't been updated in some countries since 2002. It should run in Windows 10 but isn't officially compatible. Laplink flags it as being potentially troublesome, but will still attempt to transfer it. You'll find the error occurs both at startup and when you try to launch Quicken itself.

Thankfully, the solution is simple: reinstall Quicken from its original CD. When prompted during setup, remove the version transferred across, along with any shared component files, then install a fresh copy, which should now work without compatibility settings.



The Windows Repair tool offers a fix for update woes.

HARDWARE

Purple haze

My new 4K monitor was working perfectly, but after launching a full-screen virtual machine the display went a strange purple hue – even after I shut down the virtual machine. I was able to fix things with a reboot but am worried it might be a sign of possible physical failure.
MANDY JONES

It may have been a one-off refresh problem, in which case you can safely ignore it – if it happens again, simply shut down and reboot everything. If the problem becomes more persistent, first check your monitor cable is plugged in snugly at both ends. Also check your PC is well ventilated and its cooling fans are doing their job – it may be linked to an overheating issue.

If you're convinced the problem isn't hardware-related, open your graphics adapter's Control Panel – such as Catalyst Control Centre (AMD) or Nvidia Control Panel – and look under the colour settings to verify they're correct. For example, CCC users should check the Pixel Format setting on the far-right tab, which should be set to RGB, while Nvidia users may have joy experimenting with the settings under 'Display > Adjust desktop colour settings'.

OFFICE

Office 365 and Windows 7

I've read that Office 365 is no longer supported on Windows 7 as of 14th January. Must I now upgrade to Windows 10 to continue using it?
KAREN CHEVALIER

While we strongly recommend you upgrade to Windows 10 for a host of reasons, Microsoft has announced that it will continue to supply security updates to

Office 365 for another three years. You won't get any feature updates, but Office itself will continue to be secure.

BACKUPS

Can I trust my backup?

While I diligently back up, I've no idea that any of them work. How can I test they're all okay?
PHILLIP LEVELL

Neither of Windows' built-in backup tools – File History or the older Windows 7 Backup and Restore tool – have verification options, leaving you at the mercy of both. You'll only know if your data has been safely backed up when you try to restore it.

A better approach is to switch to third-party tools with built-in verification options. For example, Macrium Reflect Free users should switch to the Restore tab and click 'Other actions' next to a backup to select 'Verify image' to manually check it. You can also have backups verified when they're created by editing your backup definition file under 'Backup > Backup Definition Files'. Select 'Advanced Options > Auto Verify Image' to do so. Similarly, EaseUS Todo Backup Free (**www.easeus.com/backup-software/tb-free.html**) also allows you to check both file- and image-based backups for corruption – select 'Tools > Check Image' to manually check.

APPLICATIONS

Transcribe video easily

I have some old video interviews of a family member that I'd like to transcribe to text. Is there some way to automate this process? There's over 20 minutes of interview to capture.
ARTHUR EVANS

You could invest hundreds of dollars in a program like Dragon Professional (**www.nuance.com**), but for one-off transcriptions you're better served paying an online service like Sonix (**https://sonix.ai/**), which charges $10 for an hour of transcription. In either event, you'd still need to compare the transcription with the original recording to catch any errors.

Alternatively, if you're happy to transcribe it yourself, but want a bit of help, then use a free tool called Listen N Write (**https://sites.google.com/site/elefantsoftwarefreeware/listen-n-write-free**) which works with a wide range of video and audio files. Load in the file, then press F12 to launch the Smart Pause N Play dictation feature. Finally, type your transcription into the text editor window. The dictation feature pauses the playback every five seconds for a second or so to give you time to keep up. Manual playback controls can also be used, and you can alter both playback time and length of pause via the Options menu.

Office 365 will continue to get security updates in Windows 7.

NETWORKING

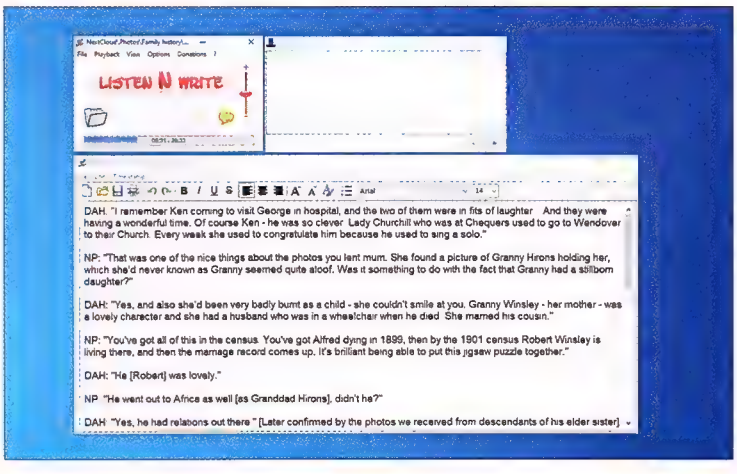
Networked PCs can't connect simultaneously

I recently bought my wife a laptop, and she's fine using it until I switch on my desktop, at which point her connection drops. She then gets an on-screen prompt about IP address conflicts every few minutes and can't get back online until I shut down.
ANDREW GOSHAWK

Ordinarily this would be a classic case of both computers being allocated the same IP address – typically when one is assigned a static IP address that's within the range of addresses allocated by your router's DHCP server. Yet on closer inspection, both PCs had different IP addresses, so this shouldn't have applied. It was at this point we discovered Andrew was using a very old piece of networking software – HomeNet Manager – as an additional layer of security. Andrew's PC was still running Windows 7 at this point – so we advised him to remove the program before upgrading to Windows 10.

As soon as the HomeNet Manager software had been uninstalled, his wife and he were both able to access the network simultaneously.

From now on, Andrew's chosen security software should provide adequate security for both PCs on his network; if he wants to occasionally check for possible intruders, log into your router's administration page to see a list of connected devices; if it doesn't support this feature, try a tool like Advanced IP Scanner (**www.advanced-ip-scanner.com**) instead. It's free.


LISTEN N WRITE
DAH: "I remember Ken coming to visit George in hospital, and the two of them were in fits of laughter. And they were having a wonderful time. Of course Ken - he was so clever. Lady Churchill who was at Chequers used to go to Wendover to their Church. Every week she used to congratulate him because he used to sing a solo."
NP: "That was one of the nice things about the photos you lent mum. She found a picture of Granny Hirons holding her, which she'd never known as Granny seemed quite aloof. Was it something to do with the fact that Granny had a stillborn daughter?"
DAH: "Yes, and also she'd been very badly burnt as a child - she couldn't smile at you. Granny Winsley - her mother - was a lovely character and she had a husband who was in a wheelchair when he died. She married his cousin."
NP: "You've got all of this in the census. You've got Alfred dying in 1899, then by the 1901 census Robert Winsley is living there, and then the marriage record comes up. It's brilliant being able to put this jigsaw puzzle together."
DAH: "He [Robert] was lovely."
NP: "He went out to Africa as well [as Granddad Hirons], didn't he?"
DAH: "Yes, he had relations out there." [Later confirmed by the photos we received from descendants of his elder sister]

Listen N Write simplifies the process of transcribing audio.

Enable G-Sync on a FreeSync monitor

Phil Iwaniuk shows how to get smooth G-Sync frames on many non-compatible monitors.

The problem is clear and simple: Sometimes games produce screen tearing and stuttering. They don't mean to, it's just a function of the way your graphics card and monitor interact – GPU spews out frames as quickly as it can, monitor uses those frames at a set refresh rate, gamer looks on at torn images in frustration.

This being the wonderfully infuriating world of personal computers, it's the solution that proves far more complex. V-Sync is the simplest band-aid over frame pacing issues, telling your GPU at the software level to only provide as many frames per second as the current refresh rate – usually 60. It's effective in its own way, but often introduces noticeable input lag and tanks the frame rate down to 30 if your graphics card can't handle a consistent 60.

Nvidia's G-Sync and AMD's FreeSync both offer more complex hardware-based delivery pipelines for new frame data, but previously they didn't interface – G-Sync needed a compatible monitor and an Nvidia card, while FreeSync required AMD silicon in your PCIe slot. Now the walls have come down, though, and Nvidia has enabled G-Sync on FreeSync panels. We'll show you how to get it up and running.

YOU'LL NEED THIS

A FREESYNC COMPATIBLE MONITOR
Stating the obvious, but this doesn't work with just any panel; you need FreeSync on your screen's specs.

GRAPHICS CARD
An Nvidia RTX 20-series or GTX 10-series GPU.

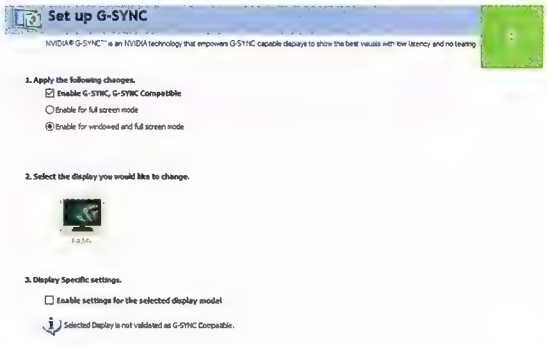
01 Update your Nvidia Drivers

That's right, we're starting with everyone's favorite chore: a driver update. GeForce Experience prompts you on the desktop whenever a new Game Ready Driver is available, but just in case you've missed one – or indeed, quite a few – open GeForce Experience, select the "Drivers" tab, and hit the green "Download" button if you see one [Image A]. If it's not there, your drivers are fully up to date. You need at least version 417.71 to use G-Sync with a FreeSync panel, so chances are you already have compatible drivers by now – support was enabled way back on January 15, 2019. It was a simpler time. Coronawhat?

Contained within these updated drivers is information that adds the option to enable G-Sync in Nvidia Control Panel, and tells your GPU not to produce more frames than a variable refresh rate monitor's current Hz when G-Sync is turned on.

02 Hook up a DisplayPort connection

HDMI won't cut it for this exercise, and although we're still deeply in love with chunky old DVI, it's not going to cut the mustard either. You need a DisplayPort cable between your graphics card and monitor for this one in order to enable G-Sync. Adaptive sync has been woven into DisplayPort's feature set since version 1.2a, so you don't need to worry overly about which DisplayPort cable you use. Your screen and GPU just need a nice high-bandwidth interface to communicate through, and because HDMI 1.4 tops out at 1080p and 60Hz, it can't keep up. HDMI versions 2.0, 2.0a, and 2.1 can go beyond those numbers, but they're rare to find on variable refresh rate monitors' back panels. Mini DisplayPort is fine, if you were wondering.


Set up G-SYNC
NVIDIA® G-SYNC™ is an NVIDIA technology that empowers G-SYNC capable displays to show the best values with low latency and no tearing
1. Apply the following changes.
Enable G-SYNC, G-SYNC Compatible
Enable for full screen mode
Enable for windowed and full screen mode
2. Select the display you would like to change.
3. Display Specific settings.
Enable settings for the selected display model
Selected Display is not validated as G-SYNC Compatible.

03 Check your monitor's compatibility

So, your graphics card meets the requirements, and it's using the drivers needed too. You've got a DisplayPort cable connecting it to your monitor, and you're primed and ready for silky-smooth frame delivery. What next? Well, next is a bit of expectation management. Nvidia itself has tested over 400 different monitor models with variable refresh rate on their spec lists, and of those 400, it's certified, er, 12. Aka "not very many." Here's the list of fully certified models – if yours is name-dropped, you can guarantee total compatibility: Acer XFA240, Acer XG270HU, Acer XV273K, Acer XZ321Q, AOC Agon AG241QG4, AOC G2590FX, Asus MG278Q, Asus VG258Q, Asus VG278Q, Asus XG248, Asus XG258, and BenQ XL2740.

What's Nvidia's criteria? Partly it comes down to the ratio of refresh rates a given panel offers. The screens that made the grade offered 2:4:1 refresh rate ratios or higher (that's at least 48–144Hz, to put it in more relatable terms). When G-Sync was enabled on these panels, they exhibited no off-putting behavior,

such as blanking, pulsing, flickers, ghosting, or any other artifacts.

If your panel isn't, by a remarkable stroke of luck, one of those 12, that doesn't mean you can't use G-Sync with it. Just prepare for the odd glitch or compatibility issue. Ultimately, it's up to you to determine whether you feel the benefits, and weigh them up against any issues that might creep in.

04 Enable variable refresh rate

This step's about delving into that darkest, most un-user-friendly of domains in all of PC gaming: your monitor's settings menu. And, unfortunately, we're not talking about Windows display properties but the real deal: that baffling array of terse criteria you bring up on your screen by hammering a random selection of flimsy plastic buttons, placed at the least easily accessible height and angle possible. Seriously, we've got UEFI BIOSes with full mouse support, but our monitors can't handle more than an unresponsive flip-book of settings?

Soapbox dismantled. For this step, you simply need to ensure that your own monitor has variable refresh rate enabled in its settings menu. Many don't come out of the box with this enabled either, so it's definitely worth checking. Unfortunately, we can't guide you through the specific labyrinth of your panel's options, but if you're not out of there in 10 minutes, we'll call the police to come and rescue you.

05 Enable G-Sync in Nvidia Control Panel

Now comes the relatively easy part. With all your hardware complying to requirements, all that's left is to open up Nvidia Control Panel and turn G-Sync on. You can access Control Panel by right-clicking the Nvidia icon in your system tray – you might need to click the arrow first to "show hidden icons" – or simply by looking for it in Windows Search Bar next to your Start icon [Image B]. Once you're in, head to the "Display" header then "Set up G-Sync." Now check the "Enable G-Sync G-Sync Compatible" option, and enter the options you want to use. Select your monitor in the drag-down menu, then check "Enable settings for the selected display model" and "Apply settings." Congratulations, you've turned FreeSync into G-Sync.

06 Test your results

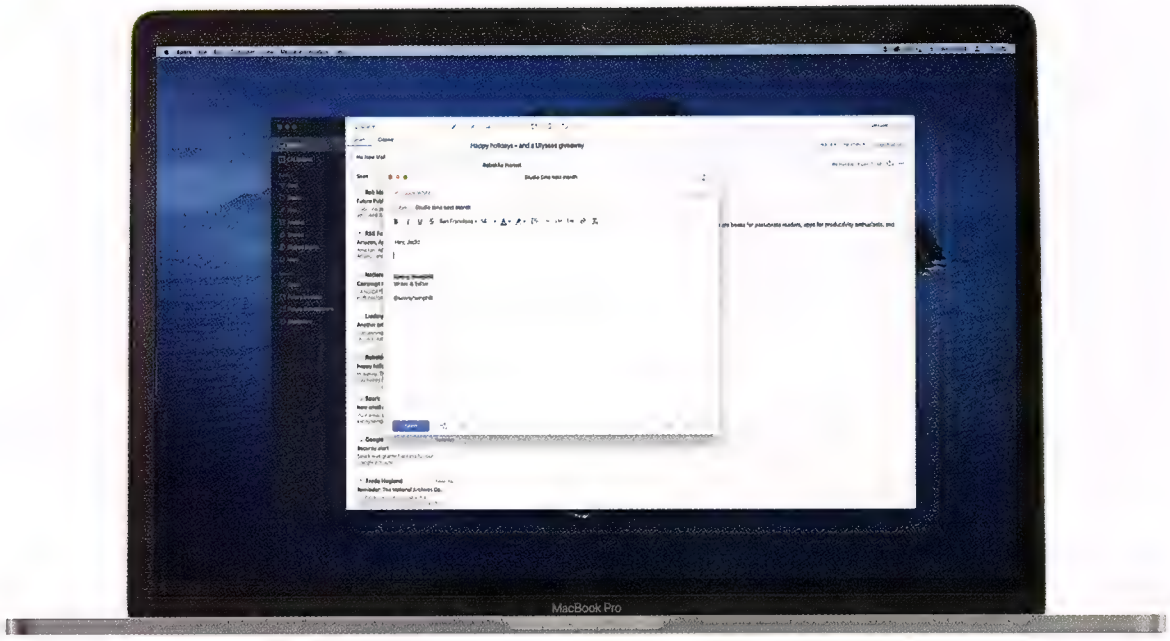
Is your work over? Forget it. Next you need to ascertain just how compatible your monitor is with its new-found G-Sync functionality. The best way to do it is to load a particularly demanding game, something you'd expect to see reasonable frame rate variance in, such as Metro Exodus or Battlefield V [Image C]. Keep an eye out for freezes, flickering, or any other odd behavior that wasn't present in your monitor before. If you do see something odd, there's not much recourse at this point. Again, it's a matter of weighing the pros against the cons, and deciding whether to keep that G-Sync box checked. There's always the possibility that future driver updates from Nvidia might improve things, too, so don't write it off completely if your panel won't play ball at this point.

07 Do you play better with or without?

Finally, there's one more question to face: Maybe you can play with G-Sync now, but should you? If you're a competitive FPS player, you might actually prefer to leave it disabled. Running games at high frame rates that go above your monitor's highest refresh rate could introduce some input lag, and in some titles, that's a game-breaker [Image D]. If the title in question allows you to set a frame limit, you can minimise that lag by setting the cap below your refresh rate. Some players might simply prefer to game at 300fps and go without G-Sync altogether, though. With margins this small – and they are small – it comes down to feel. And if something feels smoother with G-Sync enabled, then lean into it, and happy headshotting. But if not, don't feel like you're missing out if you prefer the responsiveness of an unsynched 300fps.

A G Thing

Why would you even want G-Sync over FreeSync, or even V-Sync for that matter? Let's delve into the specifics of how Nvidia's frame-pacing solution works. Because monitors and graphics cards operate at completely different cadences in a non-G-Sync environment, screen tearing and stuttering kick in when the graphics card's render time is slower than the monitor's refresh rate. It hands over incomplete frames for the screen to update itself with, or simply doesn't deliver the goods in time and skips frames. By adding an additional bit of circuitry into the monitor, G-Sync makes the refresh rate march at the beat of your GPU's drum, rather than the other way around. It means you're always seeing complete frames on screen, because your monitor only ever asks your GPU for a new frame once it's done rendering it. This doesn't magically eradicate any variance from the frame pacing, but it lessens the severity of the effect. Watching a game go from 60fps into the low 20s is a jarring experience without any kind of frame pacing solution, but assuming your GPU can at least match the screen's lowest adaptive refresh rate (usually 48Hz and thus 48fps), you won't see stuttering with G-Sync enabled.



MAC

Take control of your inbox

Make your email communications more productive with Spark.

There's no shortage of email apps to choose from on the Mac, and with Apple's own mail app getting a decent upgrade in Catalina, you might wonder why you'd bother with anything else. Well, in Spark's case, the answer is productivity.

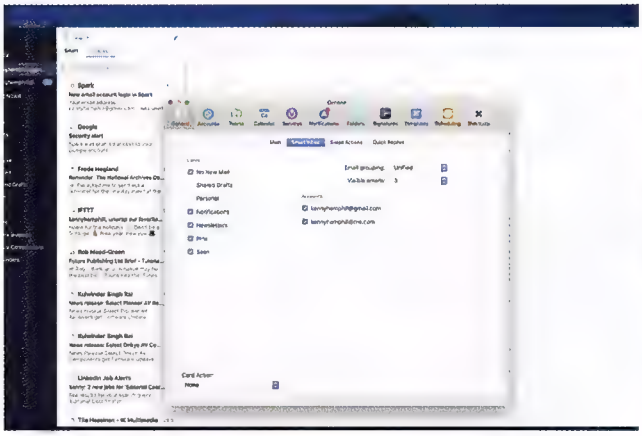
Whether it's customising smart inboxes to surface important messages, collaborating on a draft message with a team, delegating messages, or using actions to move them, Spark has a ton of features to help.

Spark is also available on iOS and iPadOS, so you can sync messages with your iPhone and iPad. Spark also allows you to create template messages so that if you have emails you send regularly, you don't have to write them from scratch each time. It has a customisable Gmail-style Quick Reply feature, and you can add smart folders to filter incoming email. Spark is free to download and use, but if you need to collaborate with more than a couple of people, there's a premium upgrade designed for teams.

IT WILL TAKE
45 minutes

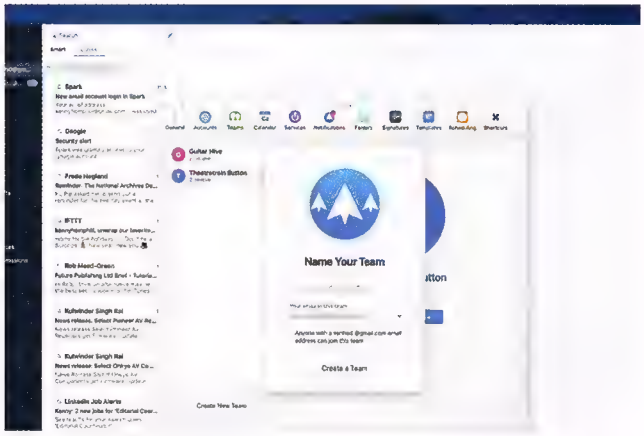
YOU WILL LEARN
How to take control of your email inbox using Spark

YOU'LL NEED
Spark for macOS



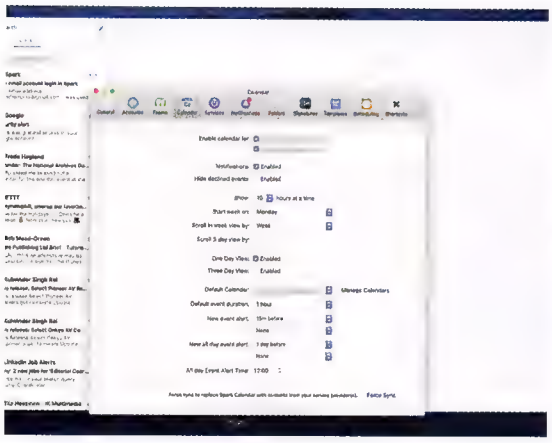
01 CUSTOMISE SMART INBOX

Click on the Spark menu and choose Preferences, then General. Select Smart Inbox. Choose which cards you want to enable on the left. Choose an action from the bottom. Choose which account it should apply to.



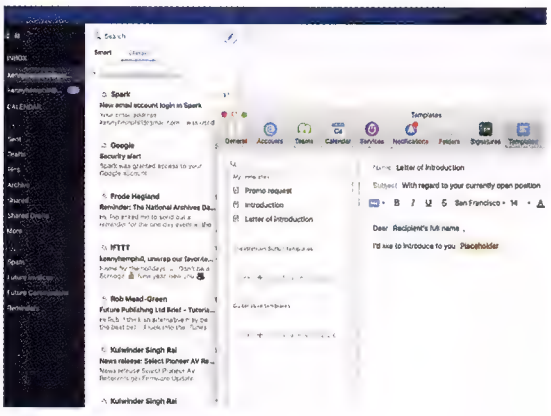
02 CREATE A TEAM

In Preferences, choose Teams → Create New Team. Give it a name and press Create a Team. Click on Manage Team & Profile. On the Team Preferences page, click Members, then Add Members to add your teammates.



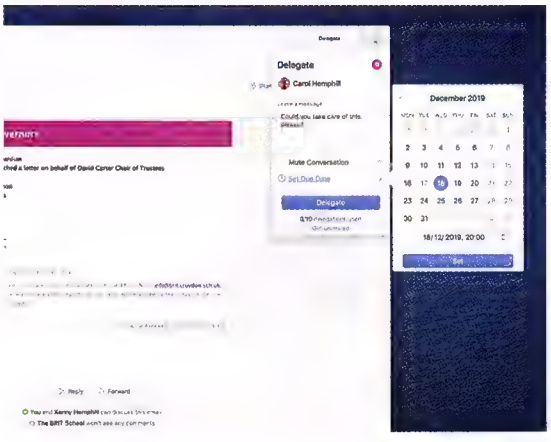
03 ADD A CALENDAR

You can add Google, Exchange, or iCloud calendars. In Prefs, choose Accounts and then the account for which you want to enable the calendar. Use the Calendars tab to set a default calendar and customise how it is displayed.



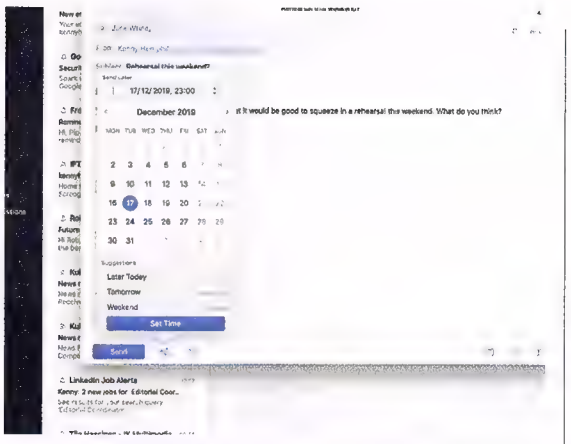
05 CREATE A TEMPLATE

Go to Prefs and choose Templates. Click + and choose from the menu. Give the template a name and fill in it, using the ABC button to add placeholders. To use a template, start a message and click the templates button.



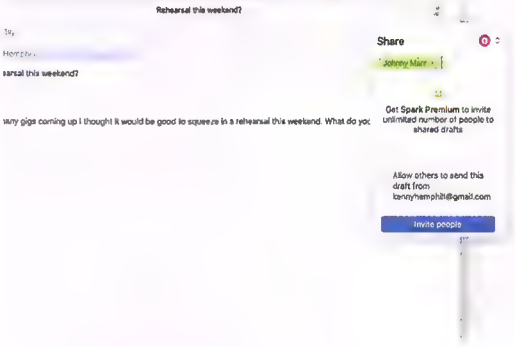
07 DELEGATE AN EMAIL

First create a team and add members. Open the email message you want to delegate, click Delegate, choose a team then start typing a colleague's name. Add a comment, set a due date and time if necessary, then click Delegate.



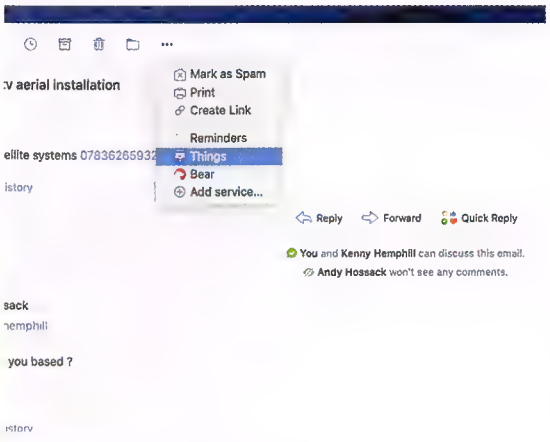
04 SCHEDULE A MESSAGE

Start writing an email. When ready, click the Send icon with a clock on it. Choose from the suggestions, or manually set a date and time. Press Set Time, then close the message. You can customise suggestions in Preferences.



06 SHARE DRAFTS

In a message window, click the head-and-shoulders icon at the top right and choose a team, then a contact. After agreeing to collaborate, they will be able to see the draft and chat to you in real time about it.



08 SEND TO OTHER APPS

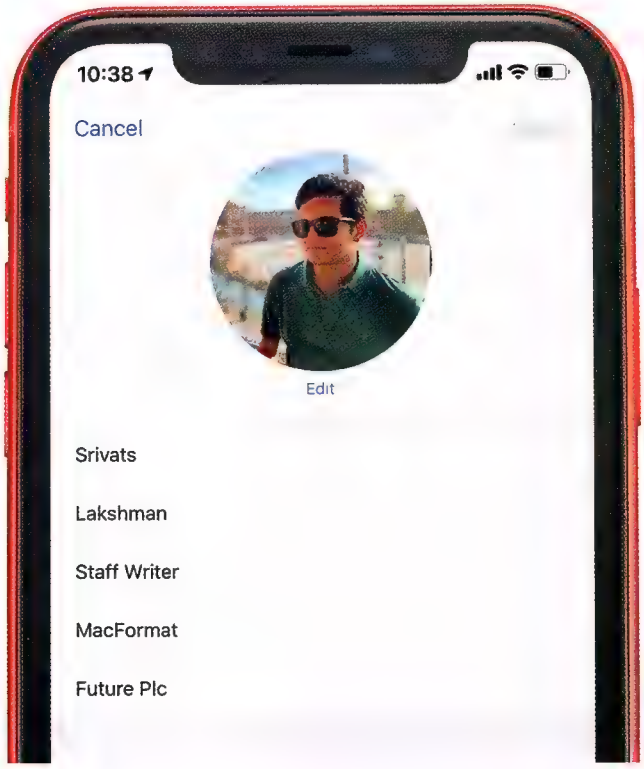
In Preferences, choose Services, then add a service. Authorise it if requested. To send an email to another app, click the More icon at the top right and choose the app. Choose whether to send the email or a link to it. Click Save.

JARGON BUSTER
Services are other apps installed on your Mac that can connect with Spark. For example, you can create a to do in Things by forwarding a message.

GENIUS TIP!
You can change the category of an email by clicking on the menu and the top right of a message and choosing from the list of options, such as Personal or Newsletter.

GENIUS TIP!
When you delegate a message, you can use the mute option to ensure you're not disturbed by notifications for the conversation.

"If you frequently broadcast a message to a group of people, why not create a group so that you don't have to manually add them each time you send a text? Or how about linking contacts by their relationship, so that you can call your plumber, boss or sibling without having to search for their name?"



iOS

Make more of Contacts

The Contacts app is capable of doing so much more than storing names.

Apple's built-in Contacts application is home to all the phone numbers, email IDs and addresses you save. Did you know that it can do so much more though? If you frequently broadcast a message to a group of people, why not create a group so that you don't have to manually add them each time you send a text? Or how about linking contacts by their relationship, so that you can call your plumber, boss or sibling without having to search for their name? To take advantage of these awesome features, you will need to sync your contacts with iCloud. While some features will work without iCloud, using iCloud simplifies the process.

Adding relationships and nicknames can be done straight from the Contacts app on your Mac, iPhone or iPad, or by going to iCloud.com. However, you will need to use Contacts on your Mac to manage groups.

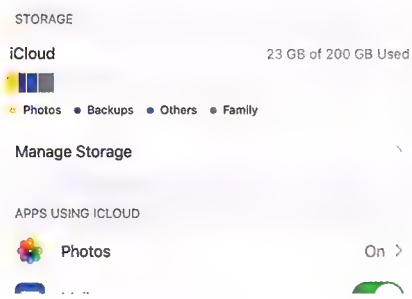
So power up your Mac, grab your iPhone, and read on to learn how to get the most out of the Contacts app.

IT WILL TAKE
15 minutes

YOU WILL LEARN
How to create groups, set nicknames and add relationships

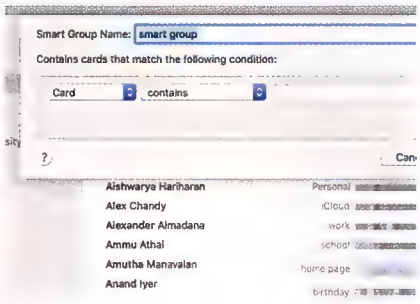
YOU'LL NEED
An iPhone with iOS 13; a Mac with macOS Catalina

HOW TO Create groups



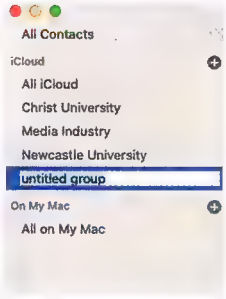
01 SYNC WITH ICLOUD

Open Settings on your iPhone, then Apple ID → iCloud. Ensure Contacts is enabled. Then go to Settings → Contacts → Default Account and select iCloud. This will ensure any new contacts created are stored in iCloud by default.



02 CREATE A SMART GROUP

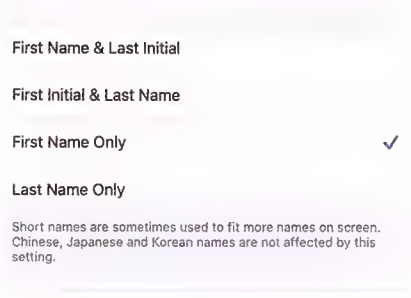
In Contacts on macOS, press up arrow-command-N to create a Smart Group. Define your criteria for that group and Contacts will automatically populate it with any contacts that match. This also applies to any new contacts you add.



03 MANUALLY CREATE A GROUP

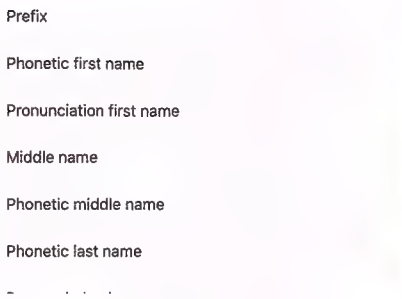
If you don't have a set of common criteria, but still want to create a group, tap the + button to the right of the iCloud label in in the left-hand pane. Name the group and then drag the relevant contacts into it to populate the list.

HOW TO Use nicknames


First Name & Last Initial
First Initial & Last Name
First Name Only
Last Name Only
Short names are sometimes used to fit more names on screen. Chinese, Japanese and Korean names are not affected by this setting.

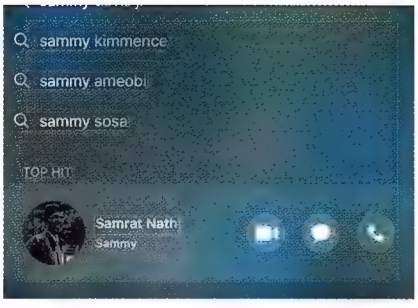
01 ENABLE SHORT NAMES

In iOS, you can enable short names. Go to Settings → Contacts → Short Name and turn the feature on. If you then opt to Enable Prefer Nicknames, you will be able to use your contacts' nicknames throughout iOS, macOS and with Siri.



02 SET A NICKNAME

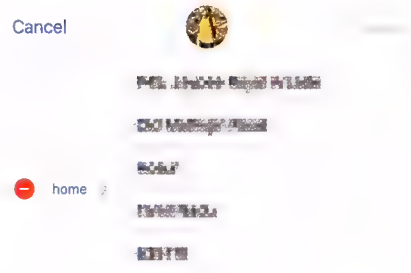
Open a contact on your iPhone/Mac and press the Edit button. Scroll to the bottom and select Add Field. From the list, select Nickname. Once you have entered the nickname, press done. You can do this from **iCloud.com** as well.



03 USE NICKNAMES

Once you have set a nickname, it will replace the full name of the contact. This means that the nickname will appear in Phone, Messages, Mail, Search and Siri; simply type in the nickname, or ask Siri, to make a call, use FaceTime and more.

HOW TO Add relationships



01 CHOOSE A CONTACT

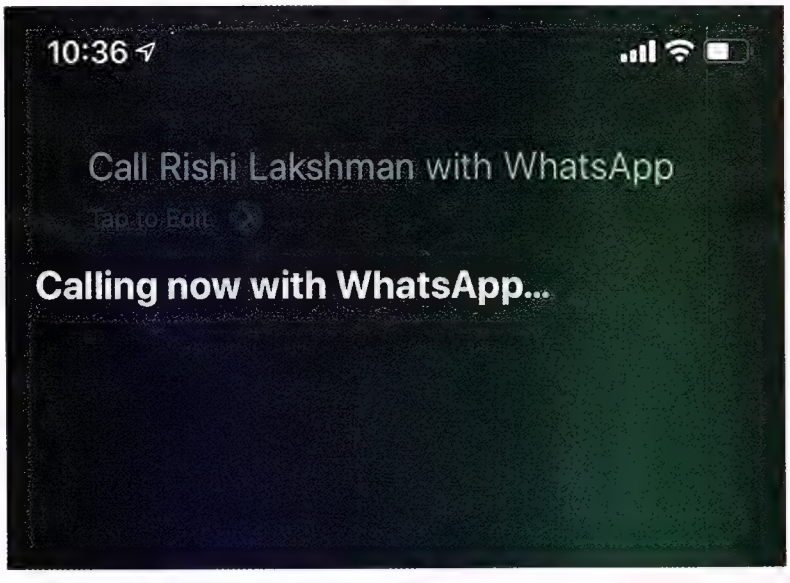
You can link any contact in your app with this feature. Open a contact then go to Edit → Add Related Name. Tap the blue 'i' button to choose a person from your contacts list. If the contact isn't in your list, type their name in the space.

02 DEFINE RELATIONSHIP

Once you have finished typing in a contact's details, you can define their relationship with you: friend, girlfriend, boss and so on. Contacts now contains 50 labels to help you do just that. You can also add your own Custom labels.

03 USE THE LABEL

After defining a relationship, you can now use it with Siri. So you can ask Siri to call your mother-in-law, girlfriend or younger brother. Siri also works with Custom labels, so you can ask it to call your manager or car mechanic as well.



Do more with Contacts

CORRECT SIRI'S PRONOUNCIATION AND USE OTHER APPS

Some apps, such as WhatsApp, work with CallKit, so you can use Siri to call via that app. Tell Siri "call [name] with WhatsApp audio" and Siri will initiate an audio call with that app. If Siri doesn't pronounce a contact's name correctly, correct it by saying "that's not how you say that name". Siri will then ask you for a sample, and will provide you with three options in an effort to match the sample. Repeat if the options aren't close enough. You can also create a shortcut (with the Shortcuts app) to call/message a contact with a third-party app like Skype.

Monitoring systems made super easy

Knowing about advanced system-monitoring tools like Glances, and when to use them, is precisely why Shashank Sharma is a celebrated Bash-ninja.

System administrators have long favoured command-line utilities for myriad activities ranging from setup, configuration, and maintenance of the machines under their charge. A necessary part of the job involves keeping tabs on the different machines. On a local installation, tools like top, htop, etc. have long reigned supreme. But if you want all the features of these, and many more, with the added convenience of keeping tabs on remote machines, Glances is just the tool for you.

Whereas utilities like top will help you gauge the CPU and memory usage, Glances goes quite a bit further. It can be used to monitor filesystem I/O, network I/O, and even sensor readouts to display CPU and other hardware temperatures. It can also show you disk usage by hardware device and logical volume, and even provide Docker statistics. Please refer to the Getting started boxout (see opposite) on instructions on how to install Glances.

Monitoring with Glances

Unlike other system-monitoring tools, Glances is capable of presenting a vast array of information. The very first line at the top is called the Header and displays the hostname, OS name and version, the running Linux kernel, IP address and system uptime. The next few lines present much the same information as you'd find on other monitors, such as top, including stats for CPU and memory usage, and load. The default interface might seem a little overwhelming, but that's understandable considering the vast amount of information that's on display. Each distinct block of information is referred to as a module, and there's a module each for CPU, memory, network stats, etc. Thankfully, you can tweak the display with different keyboard shortcuts.

From within the interface, press 1, and look at the top left of the interface. If you're running a multi-core machine, you'll notice that instead of combined statistics for the CPU usage, you now get statistics for each CPU. Glances supports many such keyboard shortcuts to show/hide a variety of information. It's also possible to sort the displayed processes by memory or CPU usage, etc.

BELOW
Many shortcuts affect the info displayed. Pressing F will enable/disable the filesystem module, F shows the used/free space in the filesystem module.

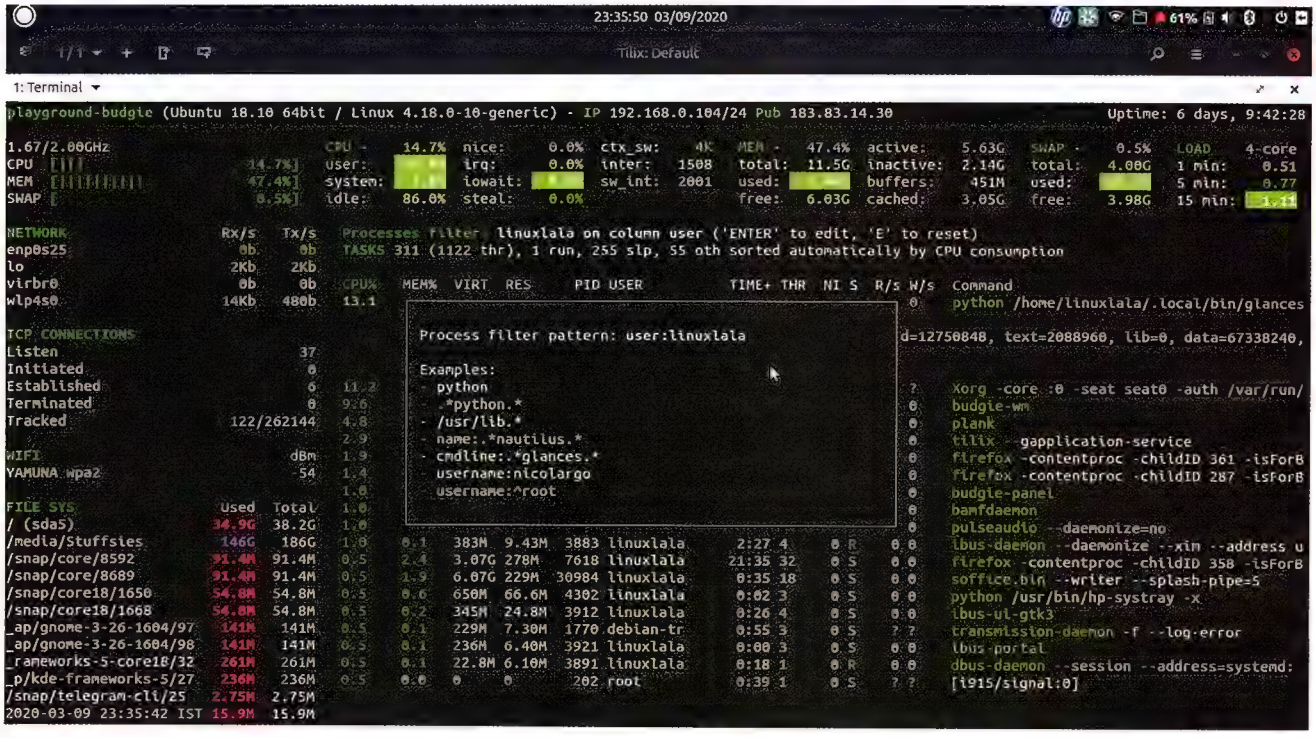
Toggle modules on/off

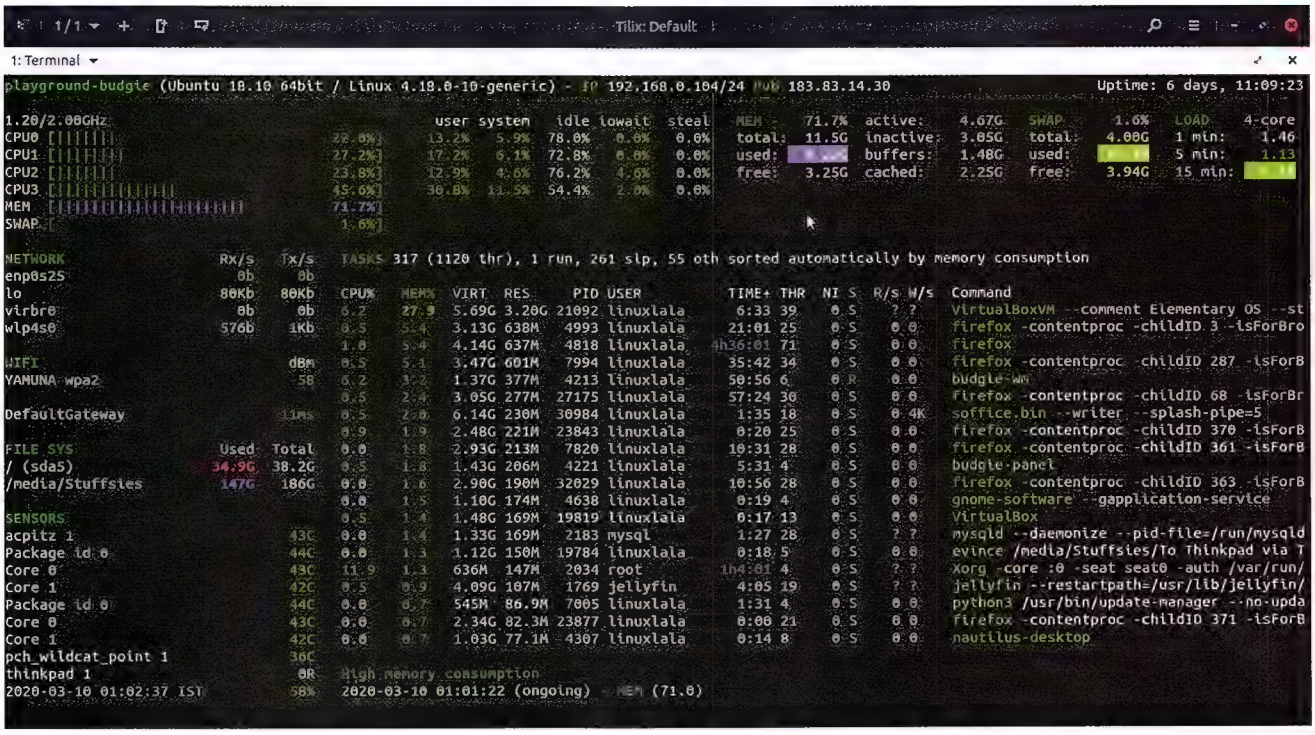
d: show/hide disk I/O stats
f: show/hide filesystem stats
s: show/hide sensors' stats
l: show/hide alert logs
n: show/hide network stats
h: show/hide help screen
/: enable/disable short process name

Sort processes

a: sort automatically
i: sort by I/O rate
m: sort by MEM%
p: sort by name
c: sort by CPU%
t: sort by time

The sidebar on the left is home to other pertinent information such as disk, filesystem, network, sensors, etc. Each of these modules can be toggled on/off using the d, f, n, and s keys respectively. You can also choose to entirely remove the sidebar from the Glances interface by pressing 2. You'll find a complete list of all configured shortcuts by pressing h from within the Glances interface. To return back to Glances, press the h key again. Although Glances doesn't need a configuration file to run, you can use one to define your custom settings, such as which





ABOVE
Colours are used to identify elements as okay (green), careful (blue), warning (magenta) and critical (red). Here, magenta and red are used to identify the low disk space.

modules are to run by default, and the values for different parameters so that the tool can warn you when something is amiss.

Depending on your distribution and the chosen installation mode, a sample config file can be found in /usr/local/share/doc/glances/glances.conf. You can place this config file in the ~/.config/glances/ directory, and Glances will automatically take cues from this config file. Alternatively, you can download the config file from the project's GitHub page (**https://github.com/nicolargo/glances**).

Remote machines

Apart from monitoring the local machine, you can also use Glances to keep tabs on remote machines. This requires Glances to be installed and running on each of the remote machines. On a remote machine, run Glances with the glances -s command:

```
glances -s
Glances XML-RPC server is running on 0.0.0.0:61209
```

Announce the Glances server on the LAN (using 192.168.0.104 IP address).

You can now access this machine from any other machine on the network by running the glances -c <ip-address> command. When you specify the IP address of the remote machine, Glances will display the statistics for that machine.

QUICK TIP
Even if you have multiple modules toggled on, Glances will only show info that can fit into the size of the screen or the terminal emulator window. There's no way to scroll through the interface and view info for other modules. Toggle on/off modules as you need them.

From the previous code block you'll also notice that Glances is running on port 61209. This is only needed if you're interested in accessing Glances from a web browser. When you run Glances with the glances -w command, you'll be informed that the Glances Web User Interface is running. You can then access the web interface by pointing your browser to the given IP address and port number.

You'll find the keyboard shortcuts that work on the Glances interface also work in the web interface.

Glances can take some getting used to, and it's bulkier than some of its counterparts, such as top. But the sheer amount of available information negates the heavier resource usage.

Its biggest drawback is that it's designed strictly as a monitoring tool, which means it can't be used to kill processes, like you can with top, for instance. But showing alerts, such as for extensive memory usage, coupled with the ability to shape the interface to only show the information you're interested in makes Glances every bit as suitable for desktop users as administrators.

Getting started

Distributed under LGPL 3.0, the utility is written in Python. This makes it cross-platform, meaning it can be installed on Windows or a Mac just as easily as on Linux distributions. You'll find Glances in the software repository of most popular distributions, but if you want the latest version or you distribution doesn't ship Glances, you can install it using pip with the pip install glances command.

Apart from getting the latest version, another advantage of installing Glances using pip is that performing upgrades is as simple as running the pip install - upgrade glances. The tool makes use of many other Python modules to provide its myriad functionality. For instance, the Pygal library is used to chart graphs, and Bottle is used to provide a web interface so you can access Glances through a web browser. You can install all of these different modules by installing Glances through pip with the pip install glances[all] command.

Once installed, you can launch the tool with the glances command. When invoked without any command parameters, the project will display more information that can fit in a regular-sized terminal emulator window. Ideally, you should run the emulator full-screen to get the most out of Glances.

Light up your life with the Sense HAT

Les Pounder reveals how we can get data and control the Sense HAT add-on board using super-easy Scratch 3.

Here we'll use the scientific powerhouse Sense HAT board with Scratch 3 to create three projects; using LEDs to scroll our name, joysticks to trigger input and sensors to read temperature and orientation.

With the power off, connect the Sense HAT to all 40 pins of the GPIO, ensuring that the board fits neatly over the Pi. Use the brass standoff provided with the Sense HAT to fix the board firmly in place. Connect your peripherals, then power up the Pi to the desktop.

From the desktop, go to the main menu and click on Programming > Scratch 3, if Scratch 3 is missing we have a solution in our Quick Tip for this project!

Scratch 3 has three main sections. From left to right they are:

- The blocks to code a project, grouped by function. These colour-coded blocks can be filtered by function.

There are also tabs for costumes, to change how a sprite looks, and a tab for sounds associated to a game.

- The central area is the coding area, where blocks are dragged to make a project.
- The right section is the stage, a place where our sprite reacts to input and produces output in a project Underneath the stage is a section to manage sprites and backgrounds.

YOU NEED

- Raspberry Pi 3B+ or 4
- Sense HAT
  - Latest Raspbian release
- Code: **https://github.com/lesp/LXF261-Scratch3-SenseHAT/archive/master.zip**

BELOW
The Scratch interface is easy to use. We have all of the projects in this tutorial together in one window.

To use the Sense HAT we need to install an extension, a library of code that Scratch uses to provide extra blocks. Click on the icon on the bottom left of the screen, and a series of extensions will be offered. Look for Raspberry Pi Sense HAT, and click on it to install. In a few moments a new section of blocks will appear, and we are ready to make our first project.

Scrolling Hello World

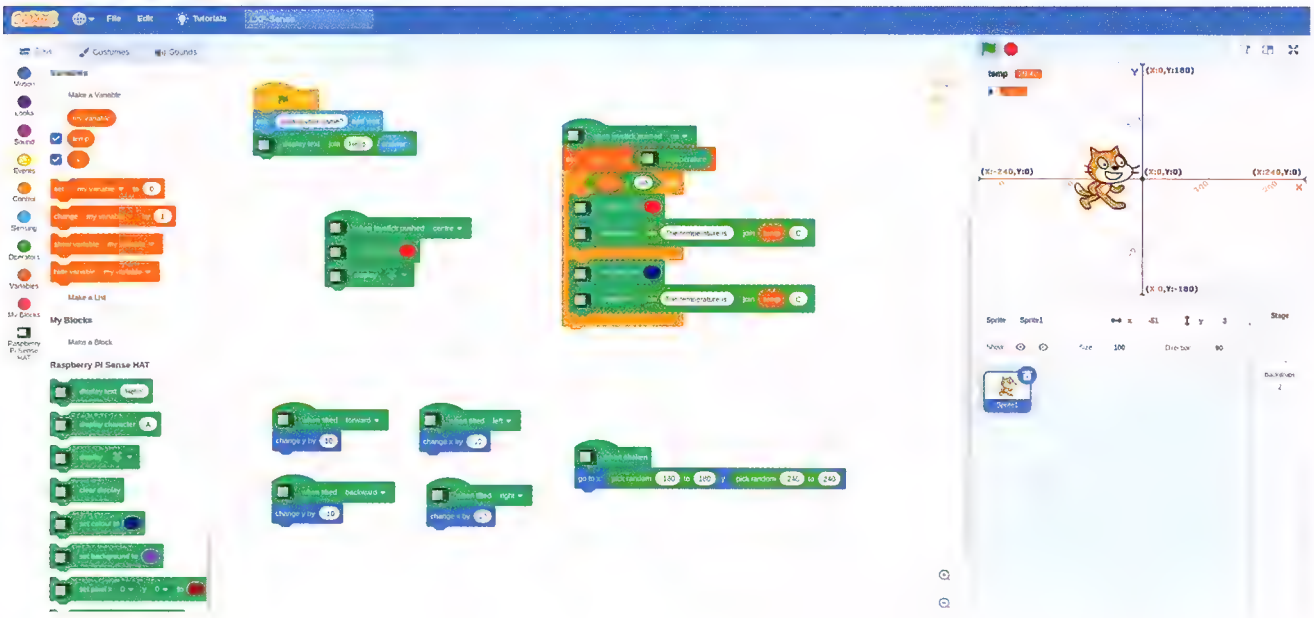
To get used to using the Sense HAT extension we are going to create a simple scrolling name project. Firstly we need to go to the Events section of blocks and drag When Green Flag Is Clicked into the coding area. The next block is found in Sensing, and it asks a question, What is your name? Drag this block and connect it under the previous block. The next block for this project is found in the Sense HAT section of blocks. This block is called Display Text. Drag this block and connect it under the previous one.

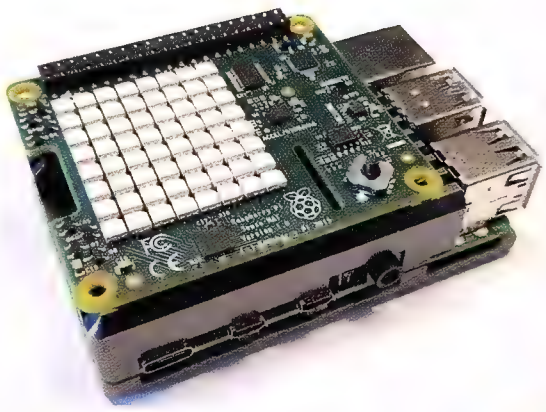
We want to say "hello" to the user, but we also want to call them by their name. So from the Operators blocks look for Join Apple Banana and drag this over to replace the word hello in display text. Change apple to Hello (the space after Hello is important!). Then go back to Sensing and drag the Answer block and drop it on top of the Banana section of the join block. By doing this the answer to the question, "Who are you?" is saved as a variable called answer , which is then used to greet the user by their name. Click on the Green Flag icon just above the stage, and the sprite will ask your name. Type in your name and watch as your Sense HAT greets you by name.

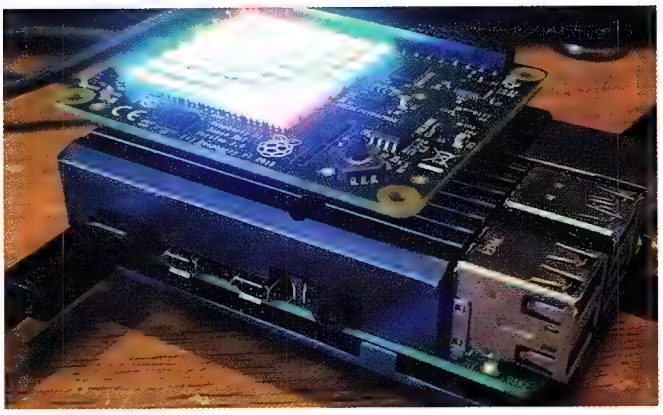
Johnny 5 neeeed input

The Sense HAT has a simple joystick that we can use for input. To test that it works we are going to write one simple project, and then one that's more complex. The test project uses the When Joystick Pressed Up block found in the Sense HAT section. Drag this into the same coding area as our earlier code, then change the direction to push the joystick from up to centre. The next block to connect is also from Sense HAT and is Set Colour To... Change the colour to something fun! The final part of this test is to drag Display... and connect it to the previous block.

The default image is some pixel art of the Pi logo. With the code complete, test by pressing the joystick centre, similar to how we can use a PS4/Xbox One analogue stick. You should see







the Pi logo on the LED matrix in a colour of your choosing.

Still in the same coding area, we'll now move on to a more complex project. This project will check the temperature using the onboard temperature sensor of the Sense HAT. It will save the temperature to a variable, then compare that variable to see if it's greater than 20°C: if it is then the text scrolling across the Sense HAT will be in RED; if it's below 20°C then it will be blue.

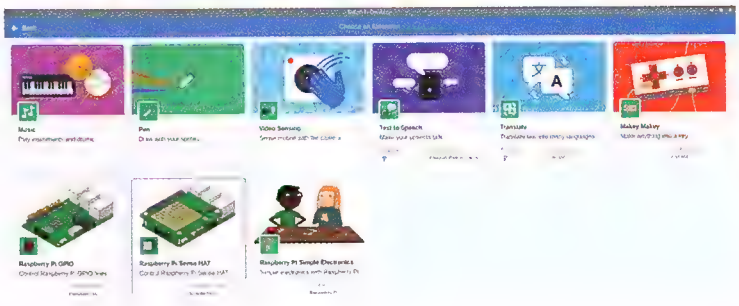
We start with another When Joystick Pressed Up from the Sense HAT block section. Then we go to the Variables section and click on Make A Variable, call the variable "temp" and accept the default options. Now from the Variable section drag Set My Variable To 0 and place it under the previous block. Change my variable to temp using the drop-down menu. From the Sense HAT section, drag the Temperature block and place it over the 0 of our Set variable block. This will update the contents of the variable temp with the current temperature read from the Sense HAT.

The next block is found in Control and it is called If, Then, Else and is a conditional test. Drag this block and connect it to the previous. To build the test we need to go to Operators and drag _ > 50 and place it inside the blank shape between If and Then. Now go to Variables and drag the temp variable block, place it over the first blank of _ > 50 and change the 50 to 20. This means if the temperature is greater than 20°C, so if the temperature is over that the text colour will be changed to red using Set Colour To from Sense HAT blocks.

Connect a Display Text block from Sense HAT, and drag a Join block from Operators and place it over the Hello! of that block. Change the first section of text to read The temperature is and in the second space drag another Join block. Then drag the temp variable and place it in the next space, and in the last space type C For the Else condition, activated if the temperature is below 20°C. Duplicate (right click) the colour and text blocks and place them inside the Else condition – just remember to change the colour! Press Up on the joystick to get live temperature data!

ABOVE
The Sense HAT works with all 40 pin GPIO models of Raspberry Pi and it provides a great selection of sensors for most school projects..

RIGHT
Adding additional functionality is easy, just import an extension, a library of pre-written blocks that we can easily drop into any project.



QUICK TIP
Is Scratch 3 missing from the Programming menu? Fear not! Go to the Preferences menu → Recommended Software and search for Scratch 3. From there it can be installed and ready to use in a few minutes.

Tilt it real

The final project uses the accelerometer to detect movement, and we shall use that to control the sprite. From the Sense HAT section drag When Tilted Forward and then from the Motion blocks drag Change Y by 10. Now tilt the Pi so that the HDMI lead points to the ceiling and the sprite moves once. Duplicate these blocks (right click), change the tilt to backwards and the 10 to -10. Move the Pi so that the HDMI lead points to the floor – the cat moves down.

To move right we need to use another When Tilted Forward and change it to "right", then from Motion use Change X by 10. Tilt the Pi right and the cat moves. Duplicate and alter the code to go left in a similar manner to going backwards. Test the code by moving the Pi around. And there we have it, three quick projects to work with Sense HAT via Scratch 3.

What is the Sense HAT?

The Sense HAT is a scientific platform created for use in schools and in space! Two Raspberry Pis are currently on the International Space Station as part of a scheme with the European Space Agency, where children can write code and potentially have it run on these high-flying Pis. The competition is called Astro Pi, and the code written by the schools can be silly or serious. Is there a north in space? Well using the Sense HAT you can find out, just as one school did.

The Sense HAT has sensors to measure temperature, humidity, pressure, magnetic forces, orientation or acceleration, and it has a lovely 8x8 grid of multicolour LEDs on which we can scroll text and display pixelated images. The joystick provides basic input – handy when you are an astronaut wearing big gloves!

It works with every model of Pi, from the original B+ to the current Pi 4, and can be used with languages as diverse as Scratch 3, Node-RED and Python, so every level of user can take their first steps. For around $40 it's great to get your kids interested in science and space!

PSU101: Understanding PC power supply units

It's the most important component in your PC, but the least understood. Darren Yates begins a new short series on understanding the basics of PC Power Supply Units.

I reckon there's no better feeling in computing than successfully designing and building your own PC system. But while we might agonise for hours about buying that slightly faster video card over that higher clock speed chip, or mull over which motherboard we really need, the component that's actually most important of all often barely rates more than a mention at the end of the build. Power Supply Units or PSUs are an ecosystem with a language and specs all of their own. But if you can learn 'PSU-speak', you're well on your way to a system build that gives you a long, happy and trouble-free life.

What a PSU does

We all know a PSU ultimately supplies power to the PC, but more precisely, it turns the nominal 240VAC or 'alternating current' mains voltage into a series of low-voltage DC or 'direct-current' rails used throughout a PC. But in the same way you can't just throw any engine into a car and expect it to run well, there's more to choosing the right PSU than just having the right plugs and sockets. So, we're going to start with the lingo – getting the terms and units of measure right will help you know what you're about to buy.

Watts, Amps and Volts

PSUs generally follow a series of standards, the most common being the ATX12V (Advanced Technology eXtended), which is currently at version 2.4. These standards lay out everything from the plugs and sockets to the voltage levels a PSU is expected to supply. However, in the end, the one key spec we all look for when buying is the DC power or 'watts' rating. It specifies the peak energy a PSU can supply to a PC and it's calculated by multiplying individual voltage rails, measured in volts, by the current they can supply, measured in amps, then adding them all together. PC standards fix the voltage to set levels, so to create PSUs of varying watts, makers change the current they supply. This is important because the PSU's one job is to supply power to PC components – and if it cannot supply enough, it'll either blow itself up or take out components on the way.

How many watts do I need?

The most common question at this point if you're building a PC is how big a PSU do you need, or more precisely, how many watts do you need? In theory, a PSU must be rated to supply at least the power required by the system. However, in practice, it should be between 50% and 100% more than this, but we'll talk about that in a moment.

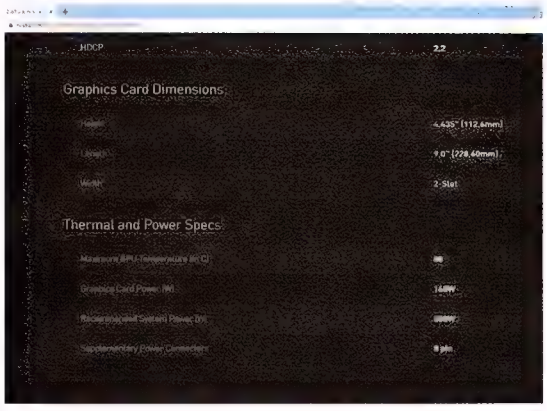
The way to determine your components' needs is to add up the individual component's power requirements. For a basic system, you're looking at a motherboard, CPU, RAM, SSD and video card. Here's how to find specs on each:

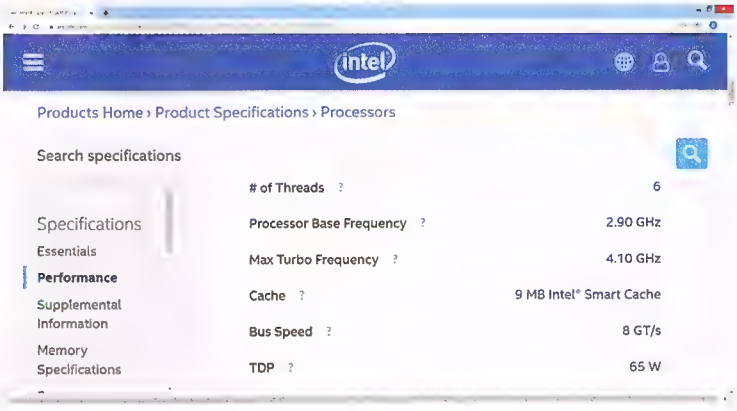
CPU

In general, chip makers provide a

"The PSU's one job is to supply power to PC components – and if it cannot supply enough of it, it'll either blow itself up or take out components on the way."

BELOW
The video card will be the most power-demanding device in your build.





TOP LEFT
Nvidia gives guidance on recommended PSU capacity on its video cards specs.

TOP RIGHT
Thermal Design Power gives you a rough guide for calculating peak CPU power.

RIGHT
A good power supply unit will go with you from upgrade to upgrade.

rating known as 'Thermal Design Power' (TDP) to rate the worst-case peak power dissipation the CPU can handle with full heat-sinking. It's not a specific electrical power rating, since, in practice, you won't reach this figure unless you run something like Prime95 or overclock it into next week. However, it is still a good worst-case guide for CPU power requirements. Intel provides this info on its ARK (**ark.intel.com**) site, and AMD on its main **amd.com** site.

RAM

According to RAM brand Crucial, you need 3-watts for each 8GB stick of DDR3 or DDR4 RAM. For simplicity, I round that up to 5-watts.

Motherboard

The companies that make and sell motherboard can't give this data because its dependent upon the video card, CPU and RAM. My rule of thumb is multiply the CPU TDP by 0.5 to get a rough motherboard power requirement to cover the various on-board extras – not just Ethernet and audio, but USB ports as well.

SSD

Solid-state drives use little power, but the key spec is the 'Maximum In-Rush Current Power Consumption' if you can find it. For example, on a 2.5-inch 500GB Western Digital 'Blue' SSD, MIRC power is rated at 7.5-watts (5V x 1.5A). Again, we can round it up to ten.

Video card

These vary power consumption depending on how hard you flog them. Search your video card maker's full specs webpage for something like 'Graphics Card Power'. For example, Nvidia's GeForce RTX 2060 has a 175-watt power rating. It even recommends a 550-watt system-wide power supply.

How to calculate total power

So, let's say we have an Intel Core i5 9400 CPU, 16GB of DDR4 RAM, a 500GB WD SSD, Nvidia GeForce RTX 2060 video card, plus a Gigabyte H370M-D3H motherboard. Adding up the ratings, the CPU is 65-watts, the RAM is 10-watts (5-watts for each 8GB stick), the SSD is 10-watts, the video card 175-watts and the motherboard is 30-watts (0.5 x 65-watts).

That gives a total of 65 + 10 + 10 + 175 + 30 = 290-watts, which means we need a PSU that can supply at least 290-watts. However, in practice, you never sail this close to the wind. To that figure, you should always add some margin of safety/upgrade 'headroom'. Go for 100% margin to be super-conservative or 70% if you're not planning on flogging the machine too much. A 100% margin doubles the 290-watt figure up to 580-watts, or pretty close to Nvidia's original recommendation. It at least gives you a ball-park figure to start looking with and shows you don't need significantly more than that.

PSU quality

However, the real mistake right now is to take that figure and find the cheapest PSU you can buy. PSUs are a mass of electronic components and not all PSUs are built to the same standards. You can buy a 550-watt PSU for $200 or buy a cheap case for $90 and get a PSU thrown in for free. First up, avoid the case-PSU bundles – not a good idea, particularly for a gaming build. My preference is for something like a Seasonic SSR-550FX. It'll cost you around $150 online, but should also last a good couple of builds. However, it's far from the only option - next time, we hit 'PSU102' level and look at 'modular' versus 'anchored' and the benefits and drawbacks of silent PSUs.

"While the source of the video footage leaks is unknown, rumours suggest they were leaked by a former developer on the project."

GAMING NEWS

The *Last of Us 2* leaks, forcing Sony's hand

Delayed indefinitely due to COVID-19 complications, the game will now release in June.

Sony delayed its highly anticipated PlayStation 4 exclusive *The Last of Us 2* in March, due to logistical problems resulting from the COVID-19 pandemic. The indefinite delay was not taken well by the fanbase, but Sony has since announced a June 19 release date.

It's unclear whether this is what Sony had in mind the whole time though, because a recent leak of some of the game's major plot beats angered both fans and the game's developer Naughty Dog. While the source of the video footage leaks is unknown, rumours suggest they were leaked by a former developer on the project. Reports in March suggested that the studio was crunching heavily in order to get *The Last of Us 2* out on time.

There has been collateral, though: it means *Ghost of Tsushima*, originally scheduled for a June release, has been pushed back to July.

Epic Games Store is finally worth using in Australia

FIVE NEW CURRENCIES WERE ADDED TO THE STORE LAST MONTH – AU INCLUDED

While the Epic Games Store has been a great source of monthly game giveaways, it's long been very uncompetitive in Australia: with an unfavourable exchange rate with the US, some new games were as much as $110. That's over now, because Epic Games has rolled out local pricing for Australia, bringing most of the prices on par with Steam.

GAMING NEWS

Fancy a crash-hot gaming PC in a mini-Tesla? It's a thing

For a sweet $13,400, you can get a drivable gaming PC.

If you're tightening your belt due to the world's current mood of instability, don't read on. Because if you do, you may be tempted to purchase a high-end gaming PC built inside the boot of a drivable mini Tesla Model S.

For US$13,432 (before shipping), you get the toy Tesla – which we repeat, is drivable – with a bonnet full of hardware. That price gets you an 11GB RTX 2080 Ti, 32GB RAM, a Ryzen 9 3900X, and a Hydro X liquid cooling system. The whole thing is underlit by Corsair iCUE RGB lighting. There are some cosmetic customisation options, but if you're hoping to downgrade any of the above listed components for a better price, we're afraid that's not an option.

When you're not using it to play games, you can invite a kid to drive the car (or you can drive it yourself, if you happen to be a kid), which has working headlights and a horn. Of course, it's a toy, so you won't be doing laps of main blaring happy hardcore in it. It won't make you quite that cool.

"For US$13,432 (before shipping), you get the toy Tesla – which we repeat, is drivable – with a bonnet full of hardware."

GAMING NEWS

A *DayZ* studio has closed, but development will continue

Bohemia Interactive has shuttered its Slovakia-based studio.

A studio which provided assistance on *DayZ* has been shuttered, Bohemia Interactive has confirmed. Based in Bratislava, Slovakia, the studio had over 40 employees at the time of its closure, according to a statement provided to *Gamesindustry.biz*.

Those employees have been offered roles in other Bohemia Interactive studios, and according to the company, the Slovakia closure was a mutual decision between management on both sides. Bohemia Interactive was quick to assure the public that development on *DayZ* will go on. The Slovakia studio had been transitioning away from its support role since early 2019, with the primary development studio based in Prague, Czech Republic.

In its January roadmap, Bohemia Interactive confirmed that *DayZ*'s development team had been reduced in order to move talent over to the company's new in-house engine. "Enfusion technology will power all of Bohemia Interactive's future titles, and to support it, some team members moved to work fully on it last June, leaving *DayZ* with a much smaller development team consisting of seasoned developers across various departments," the post read.

GAMING NEWS

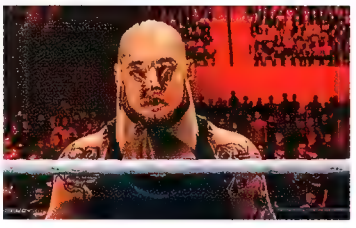
Journey is coming to Steam on June 11

The wordless *Journey* is worth the wait.

Journey is coming to Steam on June 11, just over eight years after it made its debut on PS3 and one year after it arrived on PC exclusively on the Epic Games Store.

If you still haven't played *Journey*, this will be the perfect time to give it a shot – and honestly, the less you know going in the more floored you'll probably be. If you've already played before, it will also be a lovely time to go back in for a second (or third or fourth) *Journey* years later on this new platform. Minor spoiler warning: as an online multiplayer game, seasoned *Journey*-ers can always go back in and help out neophytes on their first expedition through the desert and up the mountain. Like a *Destiny* sherpa but with encouraging chirps instead of careful raid boss instructions.

Thatgamecompany has only put out one new title since *Journey*, *Sky: Children of the Light*. Though it's only playable on iOS and Android right now, a Nintendo Switch version is planned to arrive this summer.



Afters years of quiet, *Crysis* is reemerging

AND IT'S GOING TO RUN ON A NINTENDO SWITCH

Crysis was a monster when it first released for PC in 2007, and it was such a monster that an ensuing PS3 / Xbox 360 port had to cut material in order to run. Now consoles are getting another chance: *Crysis Remastered* is coming to PC, PS4, Xbox One and even Nintendo Switch. No firm release date has been confirmed, but it looks like out-of-the-box ray tracing support will come to the PC version.

2K won't make a mainline WWE game this year

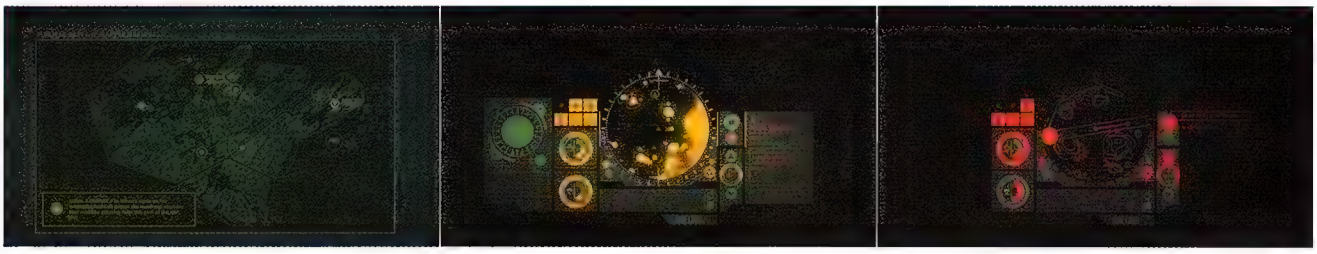
INSTEAD, WE'RE GETTING A MORE ARCADE CENTRIC SPIN-OFF.

Following the famous disaster that was *2K 2020*, the publisher 2K has decided to forgo a new instalment this year. Instead, an arcade spin-off in the form of *WWE 2K Battlegrounds* will release this spring. WWE 2K20 was the first in the series from Visual Concepts, after veteran studio Yukes bowed out with *2K19*. Given the transition, it's expected that a longer development period will help *2K21*.

WoW PlayStation and Xbox controller support being worked on

***WORLD OF WARCRAFT* COMING TO CONSOLE?**

Blizzard has confirmed its working on bringing controller support to *World of Warcraft* with the upcoming *Shadowlands* expansion, while pouring cold water on rumours that the studio was developing a console port of its hit MMORPG for PS4 and PS5. The news follows datamined game code which referenced gamepad bindings for PlayStation 4, PlayStation 4 Pro, and PlayStation 5, suggesting *WoW* would be launching on the platforms in the near future. ■



$21, PC, Mac, Switch, jumpovertheage.com

In Other Waters

Explore a beautiful and mysterious alien ocean.

The way that *In Other Waters* imagines humanity's first encounter with alien lifeforms is a bit different from other sci-fi stories. Beneath the waves of the planet Gliese 667Cc is a thriving eco-system brimming with strange alien lifeforms. The vivid descriptions of a scientist and a minimalistic computer interface tell a story of awe and trepidation, creating a serene underwater adventure like no other.

You play as the AI of an exo-suit piloted by xenobiologist Ellery Vas, a scientist who has come to Gliese 667Cc to study the alien lifeforms of this uncharted ocean. These strange beings aren't the only mystery though, Ellery is also trying to solve the disappearance of her fellow scientist, Minae Nomura. The story follows Ellery as she traces her lost colleague's footsteps through the depths of this alien ocean, trying to understand what Minae was studying in secret. You assist Ellery as she navigates the underwater landscape of this new world through a computer interface. You scan your surroundings and then decide where Ellery is going to move to, with her taking notes and making observations about the ecology and geography as you go. Ellery's vivid descriptions of your surroundings are your only way of making sense of the world, bringing those lines and symbols to life. Where I only see jagged lines on the interface's sleek design, Ellery says that we are standing on the edge of a vast underwater reef teeming with life.

In the same vein as old text adventure games, these descriptions build a strong mental picture of this world's alien ecosystem. Along with her visual descriptions, Ellery logs the species' behaviours and gives observations and educated guesses about how they fit into the larger ecosystem. The writing is so vivid it feels like I'm learning about a real ecosystem.

Ellery isn't here on holiday, though, and research is always at the forefront of her mind. Part of the interface allows you to take small samples from the flora and fauna you come across. At the research base, you can analyse them in the laboratory and the data is added to your alien encyclopaedia. Your inventory of organic samples can also be cleverly used as resources on your expeditions. Some can give you an oxygen boost and others can even influence the world, such as by making a bunch of alien stalks retract to clear the way through a cavern.

In Other Waters pulled me through fields of alien fauna, caverns filled with acid pools, through powerful currents that could sweep me away, and to the dark depths of the ocean's lower floors. It captures both the beauty and terror of the ocean.

RACHEL WATTS

A serene sci-fi story that will have you thinking about more than what lies beneath the waves.

★★★★☆

$39 | PC, XB1 | bleedingedge.com

Bleeding Edge

Doesn't do enough to stand out.

While *Bleeding Edge* may be a 4v4 'brawler', don't take that to mean that it plays like Ninja Theory's *DmC*. Instead, it's a game of timing, positioning, and cooldown management. But without a complex meta or satisfying combat, it whiffs on the 'Overwatch-but-melee' promise. Whereas Blizzard's shooter ends each match with highlights, I'm yet to see a highlight-worthy feat of skill or teamwork here.

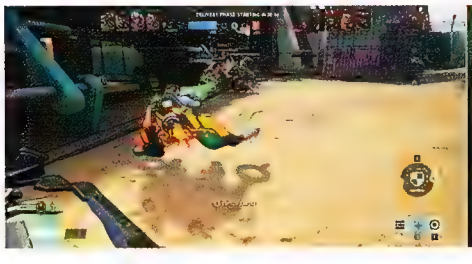
Every fighter has either a melee or ranged basic attack, three special abilities, and an ultimate. Most abilities don't have to be aimed, so winning fights is all about focusing damage in the right direction while capturing map objectives. A compelling byproduct of *Bleeding Edge*'s focus on melee combat is the importance of verticality and movement as a way to avoid enemies and pick fights.

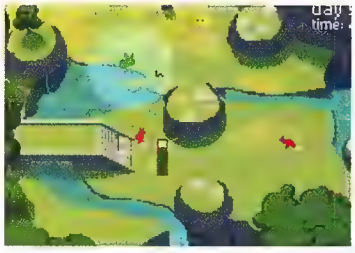
Part of the fun of hero games is theory crafting team compositions and potential counters that enemies won't expect. I haven't seen that potential across *Bleeding Edge*'s roster. Damage fighters feel more or less the same as tanks, but with less health. You can modify your playstyle a bit by equipping mods outside of matches, but the ones I've used so far are just slight boosts to abilities.

Without an expansive metagame or fun combat, *Bleeding Edge* gets boring fast. I can feel my enjoyment waning a few dozen matches in as I've learned the ins and outs of each fighter. Playing with friends on mics is more appealing, but my friend groups are much more likely to gravitate to deeper games with more opportunities for our skills to shine.

It's clear that Ninja Theory has plans to stick with *Bleeding Edge*: the official website already lists a new fighter (a dolphin in a mechanised water tank named Mekko) and art for a new map. I'll be keeping an eye on the game to see what other character designs they cook up, but it'd take an overhaul of the combat to get me back on board. Barring that, I'm not hopeful for its future.
MORGAN PARK

Very, ahem, edgy, but the combat is too shallow to hold attention for long.
★★★☆☆





Free, PC, faxdoc.itch.io/rev

Rev

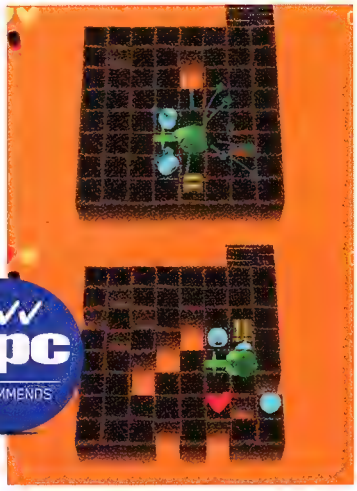
THE CHASE IS ON!

Finally, a hunting simulation with little of the associated squick factor, thanks to you playing as a pack of foxes rather than a murderous human being. In *Rev*, you'll wander around a gorgeous set of woodland ruins, looking for meat that you can drag back to your foxy den.

To locate prey in *Rev*, you have to let go of the movement keys. Sitting. Perfectly. Still. Tracks will gradually appear on-screen, glowing as they reveal the multitudinous paths of the woodland critters. It can be somewhat difficult to decipher these, but they do provide a general idea of which direction you need to head in.

Take too much damage from your defending prey and, well, nothing happens. You can take as much hurt as you like. The penalty is time lost, and perhaps your prey scarpering away, but, with no sense of fragility to the foxes, the desperate nature of the animal kingdom doesn't really come across that much here.
TOM SYKES

A fresh take on the hunting genre.
★★★½☆



Free, PC, Mac, Linux, ianmaclarty.itch.io

Pointy End

STICK WITH IT.

Positioning is everything in this clever blend of roguelike and puzzler, where you play as a helmet with a spiky shotgun attached. Every time you move from one tile to another, you twist your log-like body, either rolling across the ground horizontally, standing on end, or falling down. The exact nature of the move matters hugely, as you'll either deal damage, or leave yourself open to attack, depending on your position and facing. If you fall onto an enemy, or it makes contact with your spiky end, said enemy will perish. You also have a few shells, for a ranged attack. But when you're tipped over onto the ground, you're vulnerable to enemies. So you'll need to roll away, or stand upright as soon as you're able.

If there's a slight disconnect, then, between *Pointy End*'s two sides, that's a fair side effect of the innovation that has obviously gone into it. You won't spend serious time on it, but it's a thoughtful novelty that makes you chew over every tiny movement you make.

TOM SYKES

An innovative puzzler.

★★★★☆

$28, PC, XB1, Mac, Switch, braveatnight.co.uk

Yes, Your Grace

Look after peasants and lords.

Somebody clearly took a look at the choice-driven adventure genre, and said, "Can I king it?" Yes, you can! You see, while *Reigns* seems like a logical reference point – you play as a king, making various decisions that affect both your subjects and members of the nobility – this game delivers a meatier, more traditional gaming experience.

To begin with, it's all pretty straightforward. Entertaining lords and smelly peasants alike in the throne room, I listen to their wants and needs, and decide whether I feel like improving their dull lives. It's not quite as simple as that, of course. I only have a limited supply of gold, and the ominously generic, *Soylent Green*-y sounding 'Supplies'. But as time goes on, I find that I have the need to build up my army and make some allies. It's literally impossible to bring every lord and king onside. Their desires and interests conflict, meaning I need to choose who to woo.

The idea seems to be that, as you can't please everybody, you have to decide who to help and then hope that you made the right choice. Most of the time though, it doesn't work like that, because you ordinarily only speak to one person at a time in the throne room – and you have to make a decision before seeing the next person. There's no indication of what each person might want before you speak to them, either. There are two major battles, each of which you get plenty of notice for. Although you issue orders and make decisions during these, your impact at the time is minimal, and how well (or badly) you do is in effect decided before the big day. This, for me, is the most interesting element of the game. The first battle, I survived by the skin of my blocky teeth with just two soldiers remaining.

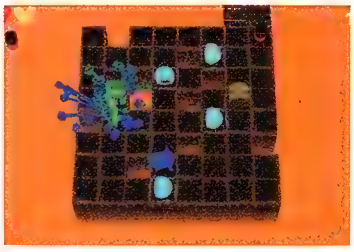
I don't have the level of control over events that I'd like (or that I feel I've been promised). Still, the story is strong and memorable.

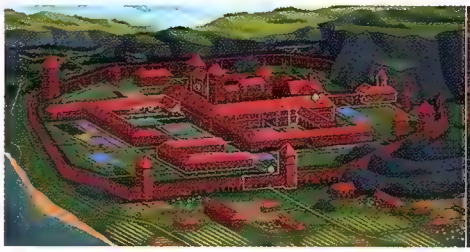
LUKE KEMP

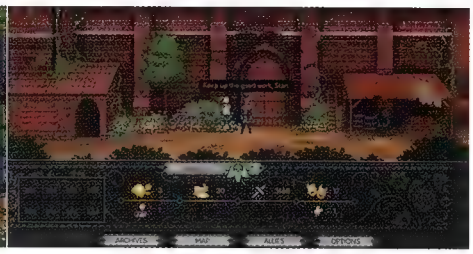
This is a kingdom that you'll want to save.

★★★½☆

"I only have a limited supply of gold, and the ominously generic, Soylent Green-y sounding 'Supplies'"







$18, PC, XB1, Mac, PS4, Switch, walesinteractive.com/thecomplex

The Complex

A visually impressive, but unambitious, live-action adventure.

In the very near future, a woman on the London Underground coughs up blood and is rushed to a facility its employees refer to simply as *The Complex*. Her body has been invaded by nanocells, an advanced technology with the potential to revolutionise medical science, if only its creators – and our protagonist, Dr Amy Tenant – could sort out that whole coughing up blood thing.

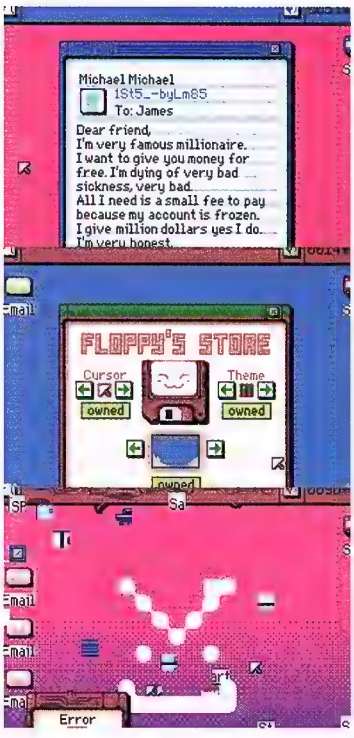
The Complex is an interactive movie, and I don't use that in the pejorative sense – it's literally what it is. You sit and you watch a series of events unfold, occasionally making decisions that alter the course the story takes. Sometimes your decisions have a major impact; sometimes they barely change anything. It's the most basic kind of branching interactive narrative, but with the production values of a TV drama.

Decisions are timed, which you'd expect from a game like this. But the baffling thing about *The Complex* is that they're timed even when what's happening on-screen isn't particularly time sensitive. Timed decisions in narrative games work well when you're forced into tense life-or-death situations, not when you're deciding which person in the lab to help you lift a box.

I won't say how, but not long into the story, Tenant and Dr Rees Wakefield, a former colleague she worked with in Kindar, and with whom she has a tense relationship, end up trapped in the depths of the complex. With gun-toting men at the door and a dwindling supply of air, the pair have to find a way to stay alive – supported by other characters including Kensington Corp's founder, Nathalie Kensington.

The Complex is technically polished, with seamless transitions between scenes and beautiful-looking HD video. The sets, lighting, and costumes are great throughout, and the cast (mostly) does a solid job with the uneven script. I also appreciate being able to skip previously viewed scenes when replaying, which lets you see the other endings without having to sit through the same stuff over and over again. But the limited interaction and forgettable story ultimately let the game down.
ANDY KELLY

A polished but disappointingly by-the-numbers FMV game.
★★½☆☆



Free, PC, hyohnoo.itch.io

Pancomos

INVADE PEOPLE'S PRIVACY.

Playing out like a trauma-free *Papers, Please*, *PanComOS* is a game that invites you to make seemingly simple decisions, as you drag emails into either the 'Send' or 'Trash' folders on a desktop. Of course, you know what spam looks like: it's a grammatically suspect plea for money. And those emails are pretty easy to spot. But, as the game gradually insists, you now have to whitelist certain email addresses, and (weirdly) to watch out for extra-terrestrials, and to scan thumbnails for the signs of malware. But, where *PanComOS* begins to shine is with its subtle moments of moral deliberation.

There's no real pay-off for your decisions, other than momentary payouts or fines, out of a pot of money you can use to purchase visual themes. It's a bit disappointing, and there's no way around that, but I reckon this well-written, funny game is still worth a play. And I'd love a bigger version that made more of its ethically dodgy core.
ANDY KELLY

Making privacy breaches fun.
★★★☆☆

Explore the galaxy from the comfort of your own bridge.

DEVELOPER TOTALLY GAMES, **PUBLISHER** ACTIVISION, **RELEASED** MARCH 8, 2002, bit.ly/bridgecommander

Star Trek: Bridge Commander

Andy Kelly revisits the greatest *Star Trek* game.

If you've ever been a *Star Trek* fan, you've probably imagined what it would be like to sit in the captain's chair of a Federation starship. Over the years there have been dozens of *Star Trek* videogames on PC, from point-and-click adventures to first-person shooters. But *Star Trek: Bridge Commander* is the closest a digital recreation of the show has ever gotten to deeply simulating the experience of being in command of a Starfleet vessel.

The game starts with a bang, literally, as a star mysteriously destabilises and explodes, killing the captain of the USS Dauntless. The ship's relatively inexperienced first officer (that's you) is then forced to take over command and find out what caused the explosion. Your character is a completely blank slate who never speaks and is never seen, or even named, with first officer Saffi Larsen doing most of the talking for you.

This is initially a little distracting, as charismatic captains who make their opinions known are an important part of the classic *Star Trek* format. But it does ultimately add to the role-playing aspect of the game, making you feel like you are the captain, and not just in control of someone else. At the start of each mission you'll get the usual *Star Trek*-style logs, explaining the current mission objectives. But because of your total lack of a voice, these are read out by other members of the crew instead.

On the bridge, the game is locked to a first-person perspective, and you never leave the captain's chair. To issue orders you have to turn your head with the mouse and face the appropriate member of the bridge crew, then choose from a list of commands. So if a Romulan Warbird suddenly de-cloaks, you turn to Larsen on your right and ask her to go to red alert, which powers up your weapons and shields. It also dims the lights on the bridge, just like in the show, which is a nice touch.

You can also go to yellow alert, which boosts your shields but leaves your weapons inactive: a good way to show an enemy that your guard is up, but you don't want a fight. But in most cases you'll be forced to defend yourself, because *Bridge Commander* is very heavy on combat, which is actually my biggest criticism of it. I love Star Trek, particularly The Next Generation, because conflict is usually a last resort. If Captain Jean-Luc Picard can solve a problem without firing a phaser, he always will. But in the game, pretty much every mission results in a space battle. It's primarily a combat sim.

In the middle of a battle, power management is key. Swing your head around to your left and you'll see your Solian chief engineer, Brex. Through him you manage your ship's power output via a series of sliders. If you want a wider scan of the area, boost power to the sensor array. If you're having trouble punching through an enemy's shields, boost your weapons. And if your own shields are taking a hammering, diverting extra power to them in classic *Star Trek* style will

increase your resilience to whoever is currently firing shots at you.

Characters in *Star Trek* are always diverting power to various systems to increase their effectiveness, so it's marvellous to see that turned into a game system in Bridge Commander. But it's all about the balancing act. Pull too much juice from the ship and your power transmission grid won't be able to cope, reducing your overall effectiveness. This power-juggling mechanic is at the core of the game's many battles, and yelling orders at Brex as the bridge shakes and sparks fly out of the consoles can be hugely exciting.

Order up

Bridge Commander captures the drama of a *Star Trek* space battle brilliantly. The screen judders as you take damage, the red alert alarm wails, and your crew shout updates about the status of the ship and the enemy's movements. You can order your tactical officer, Felix Savali, to target and attack at will or you can step in and take control, manually targeting and firing the ship's arsenal of phasers and photon torpedoes.

Honestly, most of the time you'll rely on Savali to do the hard work, because battles can go on for a long time in Bridge Commander. Sitting back, saying "make it so", and letting someone else do the work feels a lot more captain-like anyway.

There are some non-combat mission objectives, including delivering VIPs, rescuing people, beaming people aboard your ship, and picking up cargo. But this all happens off-screen, with your crew merely telling you about it rather than you witnessing it first-hand. It would have been nice to leave the bridge and visit other locations. Maybe stopping at Ten Forward for a drink, or checking up on someone in sickbay. But in this game, the life of a captain takes place entirely on the bridge. Even just taking a

DEEP SPACE

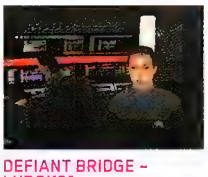
SOME GREAT *BRIDGE COMMANDER* MODS

DELTA QUADRANT PACK – JL STUDIOS

In *Star Trek: Voyager*, the titular starship got lost in the dangerous, uncharted Delta Quadrant. This pack includes 44 ships and 20 planets from the show, including Voyager itself and several Borg craft.

CROSSFIELD CLASS – THATGUYBRIAN

This adds Discovery's Crossfield class starship to the game. If you've ever wondered if the Discovery could take the Enterprise in a battle, this is your chance to pit them against each other.



DEFIANT BRIDGE – LUROK91

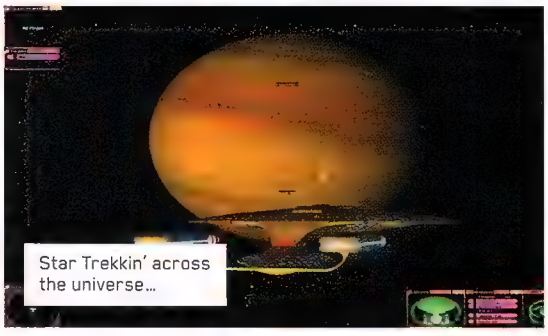
If you fancy a change from the game's default bridge designs, this replaces it with that of the USS Defiant – a warship that played a major role in the events of *Star Trek: Deep Space Nine*.

BETTER STARFIELD – IGNIS

Bridge Commander's default starfield is distractingly bad, with the same handful of stars repeated infinitely. This replacement by Ignis is vastly superior, and gives a sense of distance.

Make it so! Number one! Engage!

The Andorians were one of the founders of the United Federation of Planets.



Star Trekkin' across the universe...

few conversations in your ready room would have added visual variety.

At any time you can hit the spacebar and switch to a third-person view, which gives you a clearer view of your surroundings. There are some dramatic visuals here, including colourful alien suns and asteroid fields, but technically it's pretty ropey, with distractingly low-res textures. You can fly the ship manually in third-person, but it's much more *Trek*-like to switch back to the bridge and order your Bajoran flight controller, Kiska LoMar, to move the USS Dauntless between planets and other points of interest.

But after a few hours of play, you'll almost certainly get sick of your crew repeating the same handful of barks over and over again during combat. "Moving into attack range! Lining up forward torpedo tubes! Sweeping through phaser arcs!" Sound design is one area *Bridge Commander* falls short, with a forgettable, repetitive soundtrack, and some missing details like the rumble of your ship's engines. The weapons sound great and the voice acting is decent, but overall it's a bit of a sonic mess.

However, you can remedy this. I muted the in-game music and played the score from *Star Trek: The Next Generation* instead, which you can find on Spotify. I also found a ten-hour loop of the ambient engine sounds from the show on YouTube, and played that quietly in the background. This is possibly the nerdiest thing I've ever done, but man, it really improves the game. And thanks to a vibrant modding community, there are countless other ways to tinker with the experience, whether you want to improve the visuals or command ships from the other *Star Trek* series.

There's some nice stuff in *Bridge Commander* for *Star Trek* fans, including guests

FINAL FRONTIER

A BRIEF HISTORY OF *BRIDGE COMMANDER*

Prior to creating *Bridge Commander*, California-based developer Totally Games worked on a number of classic space sims, including the *X-Wing and TIE Fighter* series. It was then approached by Activision in 1998 to make a game based on *Star Trek*, and the studio spent six months researching, designing, and testing out ideas, until it settled on giving players the chance to sit in the captain's chair aboard a Federation starship. Totally Games later developed PC flight sim *Secret Weapons Over Normandy*, before shifting its attention to mobile games. Its final release was back in 2011.

occasionally joining your crew. In your first stint as captain you're joined by none other than Jean-Luc Picard, who sits beside you and explains some of the game's systems. Getting Patrick Stewart to reprise his role as Picard, and then using him as essentially an interactive tutorial, is a wasted opportunity. But it's still cool to hang out with him regardless, and just hearing his voice lends the game extra authenticity.

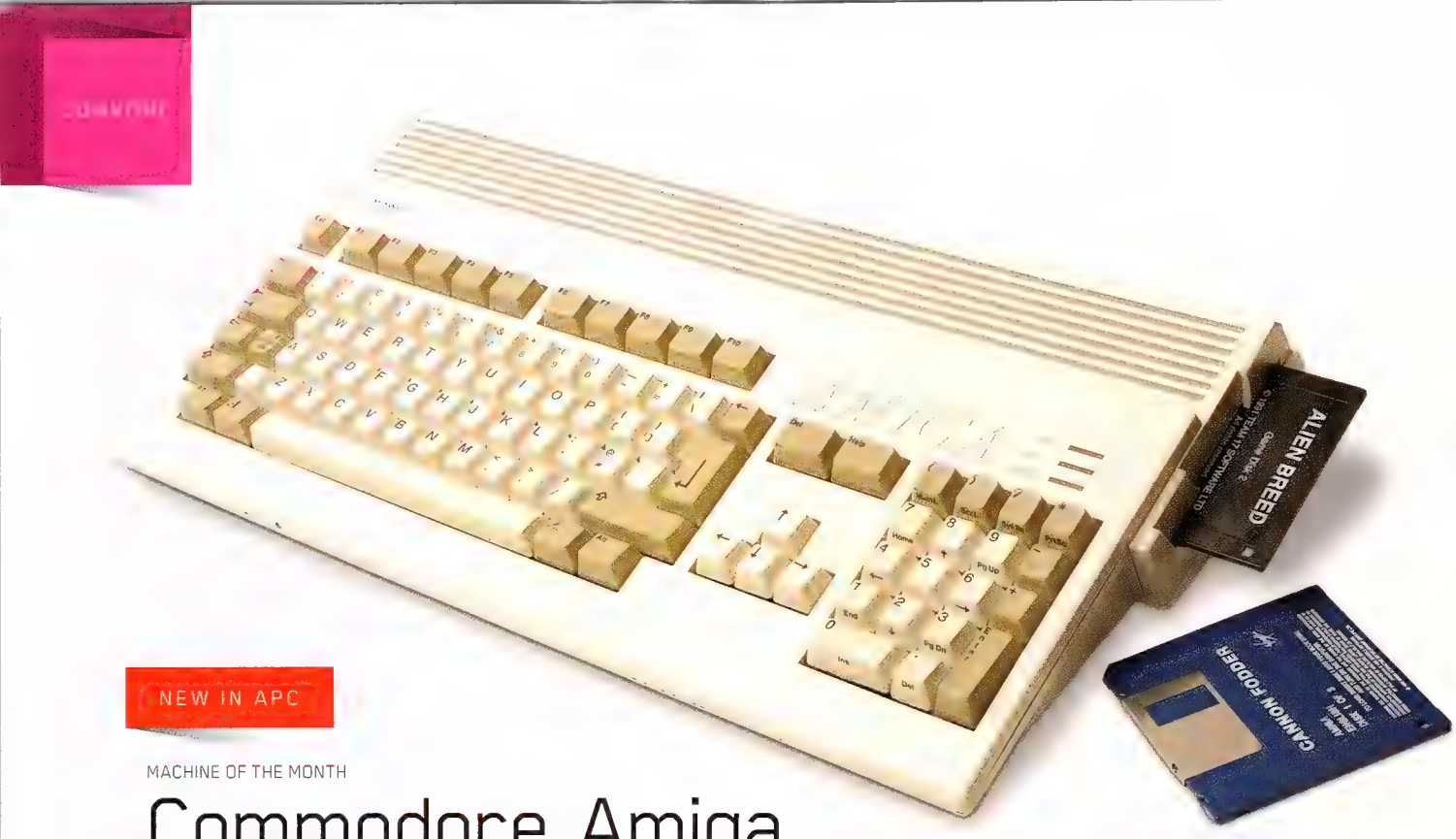
You're also joined by Data, voiced by Brent Spiner, when you swap the USS Dauntless for the USS Sovereign partway through the story. Like *Deep Space Nine*'s USS Defiant, the Sovereign was developed after the Battle of Wolf 359 to defend against the Borg. It's a more advanced ship and nimbler in battle, but I must admit, I prefer the bridge of the Galaxy class Dauntless, which looks just like the one in *TNG* – albeit with some different colouring.

Kessok run

While aboard your ship, Data determines that the exploding star was not a natural event. This revelation leads to clashes with the Cardassians and a race of aliens invented for the game called the Kessok. Occasionally enemies will hail you, either to surrender or to gloat, which adds to the *Star Trek* vibe. But I would have liked the option to engage in a little diplomacy, perhaps choosing from dialogue options to try and talk aggressors down or offer to work together. If they ever make another *Bridge Commander*, this would add some much needed non-combat variety.

If you're feeling the urge to replay *Star Trek: Bridge Commander*, you'll be glad to hear that it runs out of the box on Windows 10 without any messing around – although you will want to install the official 1.1 patch first. Finding a copy, however, might be a little trickier. It's been out of print for years, and no digital storefronts currently offer it. This is the case for a lot of *Star Trek* games, but thankfully there are several websites that archive these hard-to-find gems. There's always a way. But I'd love Activision to do a proper re-release or remaster. With *Discovery* and *Picard* getting people into *Star Trek* again, there's never been a more perfect time to do this.

It's hardly a looker – even by 2002 standards – but gaze beyond the low-poly characters and strangely flat-looking viewscreen conversations and developer Totally Games did a very decent job of capturing the ambience of a *Star Trek* ship. And if you can't stomach the lo-fi visuals, you could always give Ubisoft's *Star Trek: Bridge Crew* a go. It offers a similar experience, with modern production values, a *TNG*-themed bridge and VR support. But it's not as deep as *Bridge Commander*, designed with accessibility and co-op play in mind, so it's not quite the same. Not many vintage *Star Trek* games are worth playing today, but sitting in the captain's chair in *Bridge Commander* still has the power to thrill. ■



NEW IN APC

MACHINE OF THE MONTH

Commodore Amiga

A cult favorite in the US and Australia and a computing goliath in Europe, the Amiga was a multimedia powerhouse way ahead of its time, with functionality PCs would struggle to replicate for the next two decades. John Knight winds back the clock.

From its jaw-dropping audio-visual demos, to its brilliant sound and image editing, the Amiga would quickly establish itself as an industry favorite among artists and content creators. In spite of a slow start, its multiple advanced processors and 16-bit CPU would eventually usher in a new era of gaming possibilities.

Despite its success worldwide, Amigas are relatively rare, leaving emulation the only real option. Emulating it isn't always easy, so let us do the hard work, so you can hit the ground running with this beautiful machine.

Once upon a time...

The Amiga's story begins at Atari. Disgruntled engineers had left the company after failing to interest management in a 16-bit machine, based on the Motorola 68K CPU. In 1982, they created their own company: Hi-Toro, later renamed the Amiga Corporation. Over in Commodore land, CEO Jack Tramiel would leave the company in early 1984 and buy Atari's consumer division, giving himself an established brand to sell products under – chiefly his new 16-bit computer, the ST.

Unfortunately for Commodore, Tramiel swiped its most important engineers to work on his machine, and Commodore didn't have enough engineers to create a new 16-bit computer. Meanwhile, Amiga was bleeding cash and owed money to Atari after a rather predatory loan. As Commodore needed a new machine, it simply bought out Amiga, paid off the debt to Atari, and rebranded the Amiga as its own.

Launched in July 1985 as "The Amiga from Commodore" (later the Amiga 1000), it was a month behind the Atari ST. The Atari put up a strong fight with a lower price and twice the RAM, but the Amiga had a large 4,096-color palette, a proper multitasking GUI, and a far superior sound chip. More importantly, the Amiga was designed around multiple co-processors for audio, video, and memory access, thereby freeing up the CPU, and generally outperforming its competition.

Modification was popular, and it was common to fit expansion boards with a second CPU, allowing Mac or PC functionality. The Amiga quickly branched off into different, more advanced models, but it was the budget Amiga 500 that was the real hit.

The momentum finally hits

Released in 1987, the 500 was almost half the price of the 1000 launch. Costs were cut by repackaging the bulky desktop case into micro form, new chipsets allowed a simplified design, and lower RAM prices allowed 512K of RAM. Selling in normal retail outlets made the 500 the best selling Amiga, where it finally won its reputation as a formidable games machine.

YOU'LL NEED
COPY OF FS-UAE
An original Amiga Kickstart ROM is optional. FS-UAE runs on Windows, Linux, or Mac OS; 32-bit or 64-bit builds are available: **https://fs-uae.net**.

Advanced video hardware allowed games such as 1991's *Another World* interactive animation – it's still impressive.

If you're a non-gaming enthusiast and well familiar with Amigas, you've probably been involved in the film or television industry. By combining an Amiga 2000 with NewTek's Video Toaster (1990) expansion card, users could "genlock" with video signals, matching their refresh rates, allowing video overlays and easy effects. For a few grand, someone could get into professional video editing for less than a tenth of the cost of existing systems.

Like the Atari, the Amiga never really took off in North America, despite being American itself. The Amiga sold nearly five million machines in its lifetime – against Atari's 2.2 million sales – most of which were in the UK and Germany, with only around 700,000 sold in the US and several thousand in Australia. Therefore, most software is European, designed for PAL machines, which includes Australia.

The Amiga continued evolving, with 32-bit models in the '90s, and a failed attempt at the console market with the CD-32. As the '90s progressed, PCs were getting cheaper and Commodore could no longer compete, filing for bankruptcy in 1994. Nevertheless, you can still buy Amiga clones, and AmigaOS is still going, along with its rival, MorphOS. Both run on PowerPC, if you want to make use of an old Mac.

SPECIFICATIONS
Commodore Amiga 500 (1987)
CPU Motorola 6800 @ 7.16MHz
RAM 512KB
Graphics: 704x484, 32 colors
SOUND MOS Technology Paula
Storage: 880KB floppy disks
OS AmigaOS v1.2
RELEASED April 1987 (Netherlands), October 1987 (US)
PRODUCTION: 1987–1991
WORLDWIDE SALES 5 million

How to emulate it

Before we continue, serious users should consider commercial packages such as AmiKit and Amiga Forever, which integrate Amiga emulation into your desktop, preloaded with many classic Amiga programs. If you want to use an Amiga desktop as your actual OS, there's AROS, an open-source re-implementation of AmigaOS for standard x86 PCs and Raspberry Pis. Icaros (**https://vmwaros.blogspot.com**) is the most popular version.

Our preferred emulator is FS-UAE, available on Windows, Linux, and MacOS. For Windows, the recommended download includes a GUI interface and an executable installer. For Linux, packages should be in your distro's repository, but make sure you install not just the fs-uae package, but also fs-uae-launcher.

If these packages are older than the current release, the current version is in the main download, providing a tarball with precompiled binaries. Just extract the package, open a terminal in that folder, and enter the command:

```
$ ./Launcher
```

Before running any programs, you need to define your machine, which will be under "Amiga Model" in the main tab. Now for the tricky area of system ROMs: FS-UAE comes with an open-source replacement ROM, but its compatibility rate is very hit and miss. You'll have much better luck with a proper "Kickstart" ROM – the proprietary ROM used to run Amigas.

There are many nefarious websites with these ROM images, but legally these rights belong to Cloanto, which ships Amiga Forever, containing the Kickstart files. If you are using a Kickstart ROM, the most common Amiga model was the 500, so we recommend choosing A500 as the model, with a 1.3 ROM. If you're using FS-UAE's ROM, we had the most luck setting the Amiga Model to A1200.

Unfortunately, we only have room for showing how to run .adf disk files – equally as common are .lha files, but these take far too much preparation to document here. To load something, the main tab has a "Floppy Drives" section, but this really only works for single disk programs. For anything using multiple disks, open the "Floppy Drive" tab. Click the button on the right to browse for disk image files. For additional disks, press the "+" sign in the "Media Swap List."

Click "Start" to launch the emulator. Once it's running, Alt-Enter engages full-screen. By default, FS-UAE emulates the joystick on the keyboard, with the arrow keys for directions, and right Ctrl for the fire button. F12 opens a menu where you can pause the system, load and save states, redefine inputs (such as adding a real joystick), and change removable media.

The removable media is where you change disks when prompted mid-game. To change a disk, simply press Enter on the current disk, then you're given the selection of disks you defined earlier. ■

Find Software

Although niche, Amiga software is still an active ecosystem, with development and commercial usage continuing to this day.

You can find plenty of software on **Archive.org**, usually in .adf format, covering all types of software, including magazine coverdisks.

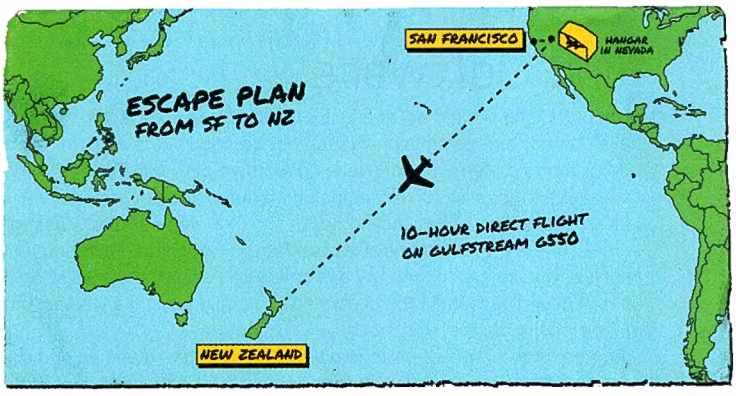
If you're willing to research how to run .lha files – though there are some .adf files, too – Aminet (**https://aminet.net**) has an exhaustive archive. The Amiga community has relied on Aminet since 1991 and still uses it now. There is all the software you could want, as well as archives of fanzines, pictures, and more.

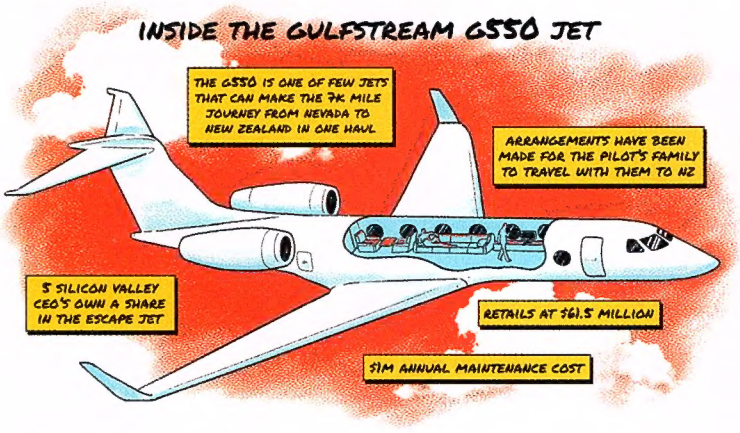
It would be remiss of us to leave out the Amiga's massive public-domain demo scene, where coders compete for the most spectacular multimedia demonstrations, often squeezed on to just one floppy disk. The Amiga Demoscene Archive (**https://ada.untergrund.net**) has demos from the '80s right up to the present. It's mostly in .lha format, but still worth browsing.

Spectacular public-domain demos are perhaps even more important to the Amiga than games.

CHIP CHAT

JOEL BURGESS REPORTS ON THE UNUSUAL SIDE OF TECH NEWS




INSIDE THE GULFSTREAM G550 JET
THE G550 IS ONE OF FEW JETS THAT CAN MAKE THE 7K MILE JOURNEY FROM NEVADA TO NEW ZEALAND IN ONE HAUL
ARRANGEMENTS HAVE BEEN MADE FOR THE PILOT'S FAMILY TO TRAVEL WITH THEM TO NZ
5 SILICON VALLEY CEO'S OWN A SHARE IN THE ESCAPE JET
RETAILS AT $61.5 MILLION
$1M ANNUAL MAINTENANCE COST

Pandemic password panic

Tech CEO forgets combination of NZ bomb shelter during coronavirus.

Multi-millionaire doomsday preppers from Silicon Valley have been buying up large tracts of New Zealand's pristine wilderness since PayPal co-founder Peter Thiel announced that the country would be 'the future' if modern society collapsed back in 2016. And it seems that some of these cunning moneybags didn't have to wait long to make use of their apocalypse shelters. General Manager of Texan bunker construction company Rising S Co., Gary Lynch, who has built a number of subterranean bomb shelters for his Silicon Valley clientele, told *Bloomberg News* that one of his high profile tech CEOs called him in March asking him to remind him of the combination for the front door so he could get into his NZ shelter. Luckily, Rising S Co. still had employees to provide it to him... this time.

New UK Tik Tok house is the Big Brother of 2020

Video clip influencers pool audience during the pandemic.

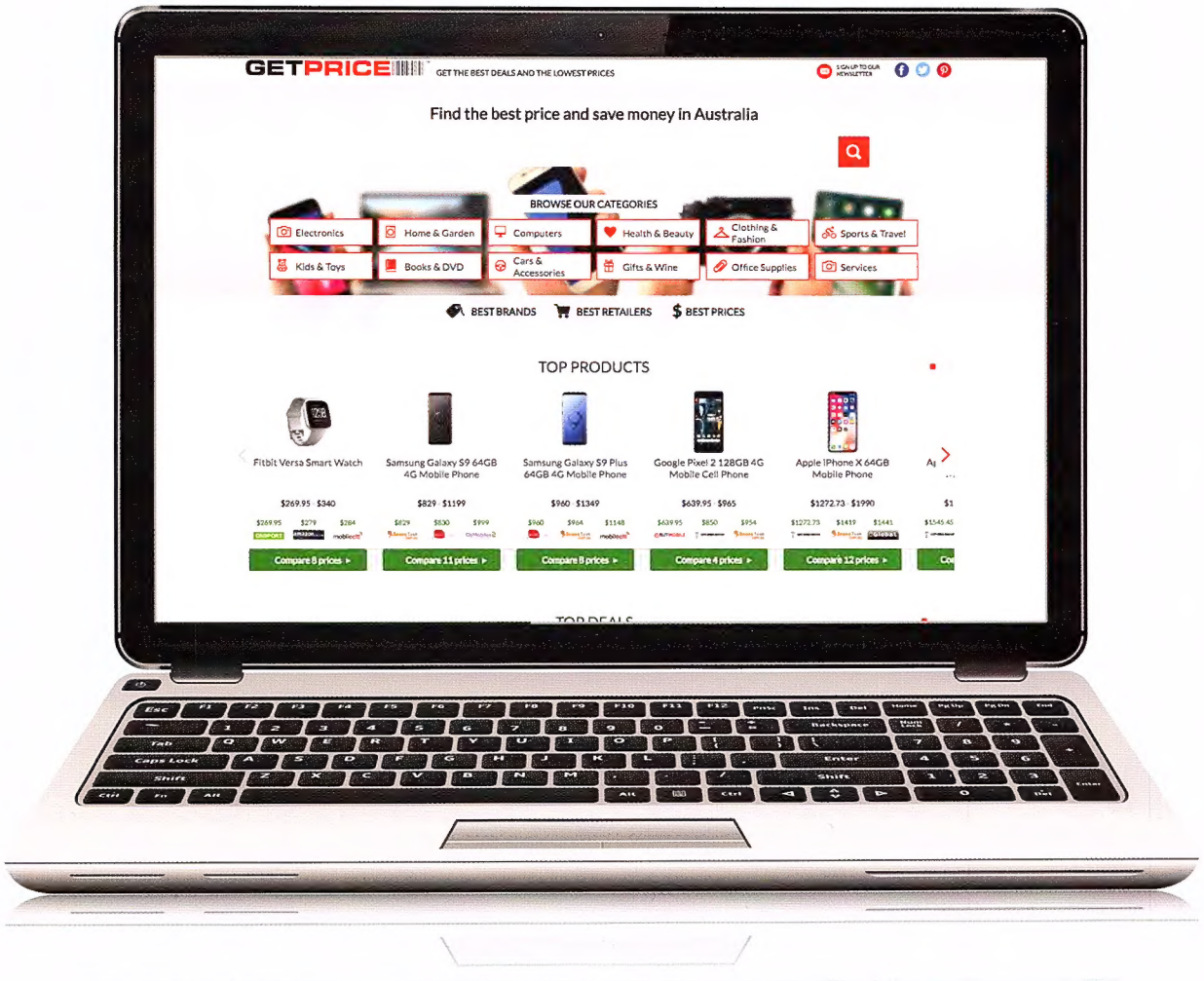
While the rest of the world is practicing social distancing, social media talent management group Fanbytes has collected up all its favourite Tik Tok influencers in the UK and put them under one roof for a constant coronavirus carousel of content. The Byte Squad, as this collection of millennial media masterminds is known, is a local emulation of the similar Tik Tok commune in the US known as the Hype House. The Byte Squad members managed to sneak in ahead of the London lockdown on March 23rd, but insist that they are taking the pandemic seriously and are even helping keep people indoors by providing entertainment for their collective 73 million weekly viewers.

Huawei included DSLR pics in phone photo competition

Huawei has been caught attempting to pass off DSLR images as photographs taken by its latest flagship smartphone, the P40 Pro, in a social media competition aimed at showcasing 'too good to be true' shots by the new quad camera array. The impossibly good shots in question were highlighted by Weibo user Jamie-hua who discovered that two images were actually captured on a Nikon D850, which retails locally for just $4,599. This is not the first time Huawei has been loose with the truth regarding its phones' photographic capabilities, boasting similar claims about a Nova 3 commercial that was implied to have been entirely shot on the smartphone but which turned out to have included DSLR footage.

Mighty marathon for a misspelled message

A nurse has used her fitness tracker to map a marathon she ran in the shape of the message 'Boston Strong' in commemoration of the 2013 Boston bombings. As one of the few outdoor activities still permitted in the current Boston coronavirus lockdown, Lindsay Devers hoped the message would fortify people, but the stunt turned out to have an additional unintended comedic effect when the health worker realised she had run the 26 mile feat in the shape of the phrase 'Boston Strog'. Taking the mistake in her stride Devers commented to the CBC Radio "I think it's great comic relief in this stressful period".



Find the best prices on the latest tech.

www.getprice.com.au

GETPRICE™

AORUS

intel CHIPSET Z490

SUPPORTS intel CORE 10TH GEN

SOAR TO NEW HEIGHTS

AORUS Z490 GAMING MOTHERBOARDS

NOW AVAILABLE IN AUSTRALIA

GIGABYTE™